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THE

SILVA OF NORTH AMERICA

A DESCRIPTION OF THE TREES WHICH GROW NATURALLY IN NORTH AMERICA EXCLUSIVE OF MEXICO

BY

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Illustrated with Figures and Analyses drawn from Nature

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VOLUME I.

MAGNOLIACEÆ—ILICINEÆ

MISSOURI
BOTANICAL
GARDEN.

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To

ASA GRAY,

FRIEND AND MASTER,

THIS FIRST VOLUME OF THE

SILVA OF NORTH AMERICA

Is Dedicated

IN GRATEFUL MEMORY.

PREFACE.

MANY years ago, when I first realized the difficulty of obtaining any true knowledge of the trees of this country, I formed the plan of writing a Silva which should contain an account of all the species that grow spontaneously in the forests of North America. The books which had been written on this subject related only to the trees of comparatively limited regions, and therefore presented no general or systematic view of the composition of our forests. Such works as existed were long out of date, too, and included none of the information collected by recent explorers and observers, and no account whatever of the trees discovered in late years west of the Mississippi River. Many of our trees have never been fully described. All that can be learned about them from books is contained in a few words of purely technical description of little value to the general reader; and these descriptions are widely scattered in American and foreign publications, to be found only in a few special libraries beyond the reach of the general reader. The difficulty of studying our trees has been increased, too, by the fact that many of them have been named by different botanists in different countries without proper regard to names previously bestowed upon them, so that such a mass of synonyms has been heaped upon some of the species that it is extremely difficult to determine the names which they should rightly bear. Books, however, are only guides towards obtaining a knowledge of trees. To be really understood, they must be studied in the forest; and therefore, since the plan of writing this Silva was formed, I have examined the trees of America growing in their native homes from Canada to the banks of the Rio Grande and the mountains of Arizona, and from British Columbia to the islands of southern Florida. I have watched many of them in the gardens of this country and in those of Europe, and there are now hardly half a dozen of the trees which will be described in this work which I have not seen in a living state.

It may be useful to glance at the books which have been specially devoted to the trees of North America. The earliest is the *Arbustum Americanum*, which was written by Humphrey Marshall, and published in Philadelphia in 1785. Marshall was a Pennsylvania farmer and a kinsman of John Bartram, who bore the title of king's botanist and enjoyed the friendship and correspondence of many European men of science. Bartram established the first Botanical Garden in America. Marshall followed his example, and collected several American trees on his farm in Chester County. Here, as well as during his numerous journeys, he acquired much information with regard to the trees of the eastern part of the country, which he

described in popular language, with much spirit and considerable acumen. His book includes an account of two hundred and seventy-seven trees and shrubs, and a few original descriptions.

The next work devoted to American trees was published in Göttingen, in 1787, by F. A. J. von Wangenheim, a Hessian officer in the employ of the king of England, who fought in the war of the Revolution, and found opportunity in the pauses of the conflict to study our trees with reference to their value for introduction into the forests of Germany. Wangenheim described one hundred and sixty-eight trees and shrubs, illustrating his work with thirty-one plates of seventy-two rude figures.

The next book which appeared upon American trees was devoted to the Oaks. It was published in Paris, in 1801, and was entitled *Histoire des Chênes de l'Amérique*. The name of André Michaux is printed on the title-page as the author of this classical work, but there is reason to believe it was really from the pen of the distinguished French botanist, Achille Richard. Michaux was a hardy and courageous explorer, with excellent powers of observation and great industry and perseverance. He possessed, however, little literary skill, and the account of our Oaks, like the Flora of North America, which also bears his name, was a work beyond his ability. Twenty of the Oaks of eastern America are systematically described and very accurately figured in this book, which was the first to give any real idea of the character and value of these trees.

Michaux resided in America during thirteen years as botanical agent of the French government, and traveled here more widely than any of his botanical predecessors. He was accompanied in many of his journeys by his son, F. A. Michaux, who afterwards wrote the best book on the trees of North America which has yet appeared. It was published in Paris, in 1810, and was illustrated with handsomely-colored plates. It includes one hundred and fifty-five American trees, the descriptions being based on observations carefully made in the forest, and carried on for several years. An American edition soon appeared, and this was followed by two American reprints, the latest bearing the date of 1859.

The work of the younger Michaux covered only the trees found in the region east of the Mississippi River and in some parts of western Louisiana. It was supplemented in 1842 by three volumes from the pen of Thomas Nuttall, a distinguished English naturalist, who devoted many years to exploring the flora of the North American continent. Nuttall described one hundred and nine American trees, including a large number of West Indian species which had been found a few years earlier on the islands of the Florida coast, and several trees from the interior of the continent and from the northwest coast, which the naturalists attached to the first transcontinental expeditions and the European botanists who early visited the Oregon Territory had brought to light. Nuttall's supplement was hastily prepared, and is very inferior in its descriptions and illustrations to Michaux's great work. A second edition was issued with the third reprint of Michaux's Sylva, under the general title of *The Sylva of North America*, the only illustrated descriptive work upon North American trees which has yet appeared.

In 1832 *The Sylva Americana* was published in Boston, in a single octavo volume. The author, Mr. D. J. Browne, made no claim to originality, and the work was a hasty compilation from the writings of Michaux and other authors. A second edition of this work, enlarged to contain accounts of several foreign trees borrowed from Loudon's *Arboretum Britannicum*, was published in New York, in 1846, under the title of *The Trees of America*.

About 1850, or a little later, Professor Asa Gray undertook to prepare, under the auspices of the Smithsonian Institution, an illustrated work on the trees of this country. Twenty-two plates were lithographed for it from drawings made in color by Isaac Sprague, but no text was prepared, and the work was then abandoned.

Another effort to prepare a Silva of America was made in 1858, when Dr. R. U. Piper, of Woburn, Massachusetts, published sixty-four pages of *The Trees of America*, illustrated with thirteen well-executed portraits of various trees selected from different parts of the country, without regard, however, to any systematic arrangement. The publication was then discontinued.

The next attempt at anything like an account of all the trees of this country appeared in 1858, in which year Dr. J. G. Cooper published, in the Proceedings of the Smithsonian Institution, a list of the arborescent species of the country, with special reference to their geographical distribution, supplementing his first paper by a second published two years later.

A catalogue of the forest trees of the United States, with notes and brief descriptions of the most important species, was published in Washington in 1876, by Dr. George Vasey, the botanist of the United States Department of Agriculture, to illustrate the collection of wood sections which formed part of the Centennial Exhibition at Philadelphia. Four hundred and nineteen species were enumerated in this catalogue.

The last general work on American trees appeared in Volume IX. of the Final Reports of the Tenth Census of the United States, published in 1883, to which I added a catalogue of the forest trees of North America with their synonymy and bibliography, with remarks upon their distribution, size, and uses, and with an account of the value and properties of their wood, based on a series of original investigations made by Mr. S. P. Sharples, of Cambridge. This catalogue contained four hundred and twelve species. It was substantially reprinted in New York in 1885, under the title of *The Woods of the United States*, as a guide to the Jesup collection of North American woods in the American Museum of Natural History.

1884(?)

A few publications devoted to purely botanical accounts of particular groups of trees, and others descriptive of the trees of parts of the country, have added largely to our knowledge of the American silva. The most important of the former are Dr. George Engelmann's papers on the Oaks and on different genera of Conifers, the result of years of patient study. The most comprehensive of the latter is Mr. George B. Emerson's *Report on the Trees and Shrubs Growing Naturally in the Forests of Massachusetts*. This work, which is a model of its kind, was published in one volume, in 1846, under the auspices of the Commonwealth. A reprint in two volumes,

superbly illustrated with lithographs printed in color from drawings by Isaac Sprague, was published in 1875.

An account of the literature on the subject, however brief, will not be complete without mention of Mr. M. A. Curtis's *Woody Plants of North Carolina*, of the valuable notes on the native trees of the lower Wabash River in Indiana and Illinois by Mr. Robert Ridgway, of the paper on the forest trees of British Columbia by Mr. George M. Dawson, and of Professor Edward L. Greene's account of some of the Oaks of California.

The line which divides trees from shrubs is a purely arbitrary one, and an attempt to separate them is often unsatisfactory. A division based on habit rather than on size seems, upon the whole, more easily applied than any other, and therefore less objectionable. So, for the purposes of this work, I have considered as trees all woody plants which grow up from the ground with a single stem, excluding all such as habitually branch at the ground into a number of stems, whatever size or height they may attain. The forests of North America exclusive of Mexico, the region embraced in this work, are now believed to contain four hundred and twenty-two species of plants, besides numerous varieties, which, under the rule adopted, can fairly be considered trees.

The sequence of the orders and of the genera adopted in the first volumes of this work is that of the *Genera Plantarum* of Bentham & Hooker, and of the standard botanical works published in the United States.

The question of nomenclature, which is beginning to occupy the attention of botanists more seriously than ever before, is perplexing. I have adopted the method which imposes upon a plant the oldest generic name applied to it by Linnæus in the first edition of the *Genera Plantarum*, published in 1737, or by any subsequent author, and the oldest specific name used by Linnæus in the first edition of the *Species Plantarum*, published in 1753, or by any subsequent author, without regard to the fact that such a specific name may have been associated at first with a generic name improperly employed. The rigid application of this rule leads to the change of many familiar names and considerable temporary confusion. But unless it is adopted, anything like stability of nomenclature is hopeless, and the sooner changes which are inevitable in the future are made, the more easily students will become accustomed to them and acquire a knowledge of the correct names of our trees.

Unless other sources of information are specially mentioned, the figures representing the specific gravity and the weight of the wood of the different trees described in this work are taken from the Report on the Woods of the United States, published in Volume IX. of the Final Reports of the Tenth Census. In most cases these are averages from several specimens, obtained, as far as possible, from trees growing under different conditions in different parts of the country. The specific gravity is calculated from specimens of wood from which all moisture was artificially expelled; the weight of the cubic foot is that of wood seasoned naturally and containing, therefore, more or less moisture.

No one can realize more clearly than I that the chief value of this new Silva is due to the accuracy and beauty of the drawings, upon which my associate, Mr. C. E. Faxon,

has worked assiduously during the last eight years, and to the skill of the admirable French engravers, who have reproduced them under the general direction of Monsieur A. Riocreux, the most distinguished European botanical artist. I take this opportunity to express to them all the sense of my personal obligation for their zeal and devotion.

The entomological notes have been supplied by Mr. J. G. Jack of the Arnold Arboretum. Mr. William D. Ely, of Providence, Rhode Island, and Mr. Francis Skinner, of Boston, have aided me greatly in collecting information relating to the early literature of many of the trees described; and Mr. Faxon's careful scrutiny of the proof-sheets has freed them from many errors. A list of the other friends and correspondents who have aided me in the preparation of this work would include the names of the chief botanists and of the most intelligent lovers and zealous cultivators of trees in America and Europe. My sense of obligation and of gratitude to them all is deep and sincere, but their number is so great that I must content myself with this general acknowledgment of their kindness and assistance.

C. S. Sargent.

Brookline, Mass., *September*, 1890.

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SYNOPSIS OF THE ORDERS OF PLANTS CONTAINED IN VOLUME I. OF THE SILVA OF NORTH AMERICA.

CLASS I. **DICOTYLEDONOUS or EXOGENOUS PLANTS.**

Stems increasing in diameter by the annual addition of a layer of wood inside the bark. Leaves netted-veined. Embryo with a pair of opposite cotyledons.

SUB-CLASS I. **Angiospermæ.** Pistil, a closed ovary containing the ovules and developing into the fruit.

DIVISION I. **Polypetalæ.** Flowers with calyx and corolla, the latter divided into separate petals.

A. **THALAMIFLORÆ.** Stamens and petals free from the calyx and from the superior ovary, and inserted on a usually narrow receptacle.

* Carpels distinct.

1. **Magnoliaceæ.** Sepals and petals in three or four rows of threes, imbricated in æstivation. Stamens numerous. Fruit cone-like, formed of the numerous cohering carpels. Leaves alternate, stipulate.

2. **Anonaceæ.** Sepals 3, valvate in æstivation. Petals 6, in two rows, valvate or sometimes imbricated in æstivation. Stamens numerous. Fruit pulpy. Leaves alternate, exstipulate.

* * Carpels united into a compound ovary with parietal placentæ.

3. **Capparidaceæ.** Sepals and petals 4. Fruit baccate or capsular, indehiscent or dehiscent. Seeds destitute of albumen. Embryo coiled. Leaves alternate; stipules often spinescent, sometimes wanting.

4. **Canellaceæ.** Sepals 3. Petals 5. Stamens monadelphous, the anthers adnate into a column. Fruit fleshy. Seed albuminous. Leaves alternate, exstipulate.

* * * Carpels united into a compound ovary with axile placentæ.

5. **Ternstrœmiaceæ.** Calyx imbricated in æstivation. Stamens indefinite, more or less united together and with the base of the petals. Fruit, a 3 to 5-celled pod. Embryo straight or slightly curved. Leaves alternate, stipulate.

6. **Cheiranthodendreæ.** Calyx subcampanulate, deeply 5-lobed, the lobes imbricated in æstivation. Petals 0. Stamens united into a column. Capsule loculicidally dehiscent. Embryo straight, in fleshy albumen. Leaves alternate, stipulate.

7. **Tiliaceæ.** Calyx valvate in æstivation. Stamens numerous, usually more or less united together. Leaves alternate, the stipules usually small and deciduous, sometimes wanting.

B. **DISCIFLORÆ.** Sepals generally distinct. Stamens as many as the petals, or twice as many, or fewer, usually inserted on a hypogynous or perigynous disk. Ovary superior, many-celled.

* Ovules pendulous, raphe ventral.

8. **Zygophyllaceæ.** Sepals 5, or rarely 4, usually free, destitute of glands. Filaments often provided with a basal bract. Disk usually fleshy. Ovary angled or lobed. Branches jointed. Leaves usually opposite, 2-foliolate or pinnate; stipules persistent.

9. **Rutaceæ.** Flowers usually diœcious or polygamous. Ovary 2 to 5-lobed, or the carpels almost distinct, on a glandular disk, often produced into a gynophore. Leaves compound, glandular-punctate, exstipulate.

10. **Simarubeæ.** Flowers regular, polygamous, or rarely perfect. Calyx 3 to 5-lobed or divided. Petals 3 to 5 or wanting, imbricated or valvate. Disk annular, lobed or entire. Ovary 2 to 5-lobed, or rarely entire; ovules usually solitary. Seeds albuminous. Leaves alternate or rarely opposite, pinnate or rarely 1 to 3-foliolate, exstipulate.

11. **Burseraceæ.** Flowers perfect or polygamo-diœcious. Calyx 3 to 5-lobed, imbricated or valvate. Disk annular or cup-shaped, free or adnate to the calyx. Ovary entire, 2 to 5-celled. Seeds exalbuminous. Leaves opposite or alternate, 3-foliolate, unequally pinnate, or rarely 1-foliolate, exstipulate.

12. **Meliaceæ.** Flowers usually perfect. Calyx imbricated or rarely valvate in æstivation. Petals contorted or valvate in æstivation. Anthers united into a sessile or stipitate tube. Ovary entire, 3 to 5-celled. Seeds usually destitute of albumen. Leaves alternate, usually pinnate, exstipulate.

* * Ovules pendulous, raphe dorsal.

13. **Ilicineæ.** Flowers diœciously polygamous, axillary, 4 to 8-parted. Disk minute. Ovules 1 to 2 in each cell. Embryo minute, in copious albumen. Leaves alternate; stipules minute.

SILVA OF NORTH AMERICA.

MAGNOLIA.

Flower-bud inclosed in a stipular caducous spathe. Flowers perfect, solitary, terminal; sepals 3; petals 6 to 12, in series of 3's; anthers introrse; pistils indefinite, imbricated on an elongated receptacle. Carpels drupaceous-baccate, persistent, opening on the back at maturity. Seeds drupaceous.

Magnolia, Linnæus, *Gen.* 162. — Adanson, *Fam. Pl.* ii. 364. — A. L. de Jussieu, *Gen.* 281. — Endlicher, *Gen.* 837. — Meisner, *Gen.* 3. — Gray, *Gen. Ill.* i. 59. — Bentham & Hooker, *Gen.* i. 18. — Baillon, *Hist. Pl.* i. 188.

Trees, or rarely shrubs, with fleshy roots, ashy gray or brown, smooth or sometimes scaly, bitter-aromatic bark, and terete branchlets conspicuously marked by large round leaf-scars and narrow stipular rings. Buds terete, acute; their scales large membranaceous stipules adnate to the base of the stout petioles, deciduous with the unfolding of each successive conduplicate leaf. Leaves alternate, entire, sometimes auriculate, deciduous or sempervirent, feather-veined, often minutely punctate. Flowers sessile or slightly pedunculate, conspicuous, sometimes precocious, often fragrant, white, green, or yellow, rarely purple or rose. Spathe thin, membranaceous, or, when the flower is precocious, thicker and densely covered with wool. Sepals spreading or reflexed, deciduous. Petals imbricated in the bud, hypogynous, concave, erect or spreading, deciduous. Stamens indefinite, imbricated in many ranks upon the base of the receptacle, stout, early-deciduous; filaments much shorter than the adnate introrse two-celled anthers; the fleshy connective apiculate. Pistils densely imbricated on the receptacle; ovaries fleshy, one-celled; style short, recurved, stigmatose only on the inner face; ovules two, collateral, horizontal, anatropous. Fruit a scarlet or rusty brown cone, formed of the coalescent two-seeded carpels. Seeds suspended at maturity by a long thin cord of unrolled spiral vessels contained in the short funiculus and placenta; testa thick, drupaceous, the outer portion becoming fleshy and at maturity pulpy, bright red or scarlet, the interior crustaceous, grooved along the inner side; tegmen very thin, adherent to the albumen. Embryo minute, at the base of the fleshy homogeneous albumen, its radicle next the hilum; cotyledons short and spreading.

The genus Magnolia is now confined to eastern North America, southern Mexico, and eastern and southern Asia. Twenty species are known. Of these, six are North American, with their centre of distribution in the southern Alleghany-mountain region; two are Mexican;[1] ten are eastern Asiatic;[2] one is a native of the mountains of Yun-nan;[3] and four are Himalayan.[4] Magnolia once occupied a much larger area of the earth's surface, and its fossil remains are well marked and widely distributed.[5] As late

[1] Hemsley, *Bot. Biol. Am. Cent.* i. 13.

[2] Maximowicz, *Bull. Acad. Sci. St. Pétersbourg*, viii. 507. — Forbes & Hemsley, *Jour. Linn. Soc.* xxiii. 23.

[3] *Magnolia Delavayi*, Franchet, *Pl. Delavayanæ*, 33, t. 9, 10: a fine tree with persistent foliage, not unlike *Magnolia fœtida* of the south Atlantic states.

[4] Hooker f. *Fl. Brit. Ind.* i. 41.

[5] Saporta, *Origine Paléontologique des Arbres*, 263.

as the Tertiary period it was common in the Arctic Circle, in Greenland, in central Europe, and on the mid-continental plains of North America.[1]

The largest of the genus is *M. Campbellii*,[2] a noble tree of the Sikkim Himalaya, where in elevated sub-tropical valleys it attains the height of a hundred feet. *M. hypoleuca*,[3] a native of mountain forests in northern Japan, is one of the largest, and perhaps the most useful of the genus. The Chinese *M. conspicua* and *M. obovata*, as well as several hybrids[4] between these species, have long been cultivated for their conspicuous precocious flowers.[5] The North American species are interesting and widely cultivated ornamental trees.

The wood of Magnolia is light or rarely heavy, moderately hard, close-grained, easily worked, although not strong or durable, creamy white or brown, quickly becoming stained with decay. The sapwood is a little lighter colored than that of the heart. The medullary rays are thin and inconspicuous. It has few economic uses.[6]

All parts of Magnolia are slightly bitter and aromatic. The dried bark, especially of the root, and the cone and seeds of several American species were formerly used occasionally as a stimulant and tonic.[7] The Chinese employ the powdered seeds of *M. conspicua* in the treatment of inflammatory troubles of the throat and eyes,[8] and the dried flower-buds medicinally, and to season rice.[9]

All the Magnolias grow freely and rapidly in cultivation; they require deep, rather moist, well-drained soil, and thrive in peaty loam. They are easily raised from seed, and may be propagated by grafting or by layers. The American Magnolias are singularly free from the attacks of injurious insects.[10]

The genus Magnolia was established by Plumier in 1703.[11] Plumier's species, however, a noble West Indian evergreen tree, with which one of the North American species of Magnolia was afterwards confounded by Linnæus, is now the type of the allied tropical genus Talauma. The name commemorates the labors of Pierre Magnol (1638–1715), professor of botany at Montpellier, who first indicated the natural families of plants.

[1] Heer, *Fl. Foss. Arct.* vii. 180. Synoptical Table.

[2] Hooker f. *Ill. Him. Pl.* t. 4, 5. — Griffith, *Icon.* iv. t. 656.

[3] *Garden and Forest*, i. 304, f. 49.

[4] Loudon, *Arb. Brit.* i. 278.

[5] The so-called *Magnolia fuscata*, a tall evergreen shrub from southern China, grown in gardens in all the temperate parts of the world for its fragrant flowers, is now referred to the allied genus Michelia.

[6] *Magnolia hypoleuca* furnishes the wood used by the Japanese in the manufacture of sword-sheaths and lacquered ware. (Rein, *Japan nach Reisen und Studien im Auftrage der Königlich Preussischen Regierung dargestellt*, ii. 259.)

[7] Lloyd, *Drugs and Med. N. Am.* ii. 41.

[8] *Nouveau Duhamel*, ii. 225.

[9] Pickering, *Chron. Hist. Pl.* 600.

[10] T. V. Chambers (*Bull. U. S. Geolog. Surv.* 1878, iv. 108) mentions a leaf-mining larva of a lepidopterous insect to which he gives the name *Phyllocnistis magnoliœella*.

[11] *Nov. Pl. Am. Gen.* 38.

CONSPECTUS OF THE NORTH AMERICAN SPECIES.

Leaves scattered along the branches: leaf-buds silky.
- Leaves persistent: shoots of the year and carpels densely pubescent . . . . . 1. M. FŒTIDA.
- Leaves subpersistent: young shoots pubescent . . . . . 2. M. GLAUCA.
- Leaves deciduous.
  - Oblong, ovate, or subcordate: flowers small, green or yellow . . . . . 3. M. ACUMINATA.
  - Obovate or oblong, cordate at the narrow base: flowers very large and white . . 4. M. MACROPHYLLA.

Leaves crowded at the summit of the flowering branches: leaf-buds glabrous.
- Leaves obovate-lanceolate, pointed at both ends . . . . . 5. M. TRIPETALA.
- Leaves obovate-spatulate, auriculate at the base . . . . . 6. M. FRASERI.

MAGNOLIA FŒTIDA.

Magnolia. Bull Bay.

LEAVES evergreen, coriaceous, ferruginous-tomentose beneath. Pistils woolly. Fruit and shoots of the year densely pubescent.

Magnolia fœtida, Sargent, *Garden and Forest*, ii. 615.
Magnolia Virginiana, *β.* fœtida, Linnæus, *Spec.* 536.
Magnolia grandiflora, Linnæus, *Spec.* ed. 2, 755. — Miller, *Dict.* ed. 8. — Edwards, *Brit. Herb.* 46, t. 92. — Marshall, *Arbust. Am.* 84. — *Icon. Am. Gewäch.* ii. 45, t. 185, 186. — Walter, *Fl. Car.* 158. — Gærtner, *Fruct.* i. 343, t. 70. — Lamarck, *Dict.* iii. 672; *Ill.* iii. 35, t. 490. — Moench, *Meth.* 274. — Willdenow, *Spec.* ii. 1225. — Michaux, *Fl. Bor.-Am.* i. 327. — *Nouveau Duhamel*, ii. 219, t. 65. — Desfontaines, *Hist. Arb.* ii. 5. — Andrews, *Bot. Rep.* viii. t. 518. — Michaux, f. *Hist. Arb. Am.* iii. 71, t. 1. — Pursh, *Fl. Am. Sept.* ii. 380. — Nuttall, *Gen.* ii. 18. — De Candolle, *Syst.* i. 450; *Prodr.* i. 80. — Elliott, *Sk.* ii. 36. — Audubon, *Birds*, t. 5, 32. — Don, *Gen. Syst.* i. 82. — Loudon, *Arb. Brit.* i. 261, t. — Torrey & Gray, *Fl. N. Am.* i. 42. — Dietrich, *Syn.* iii. 308. — Spach, *Hist. Veg.* vii. 470. — Chapman, *Fl.* 13. — Curtis, *Geolog. Surv. N. Car.* 1860, iii. 66. — Baillon, *Hist. Pl.* i. 133, f. 165–169; *Dict.* i. 557, f. — Koch, *Dendr.* i. 367. — Keisuke Ito, *Icon. Bot. Gard. Koishikawa*, i. t. 18. — Sargent, *Forest Trees N. Am. 10th Census U. S.* ix. 19.
M. grandiflora, var. elliptica and obovata, Pursh, *Fl. Am. Sept.* ii. 380.
M. grandiflora, var. lanceolata, Pursh, *Fl. Am. Sept.* ii. 380. — *Bot. Mag.* t. 1952.

A noble tree, of strict pyramidal habit, sixty to eighty feet in height, with a tall straight trunk sometimes under favorable conditions four to four and a half feet in diameter. The bark of the trunk on fully grown individuals is a half to three quarters of an inch thick, gray or light brown in color, covered with thin appressed scales rarely more than an inch long; that of the branches is smooth, light gray, and much thinner. The leaves, which fall in the spring at the end of their second year, are bright green, shining, coriaceous, oblong or ovate, strengthened by a prominent midrib and primary veins, and borne on stout petioles an inch or two long. They are five to eight inches long and two to three inches broad. The underside, as well as the petiole, winter-buds, and spathe, is coated with a thick dark rusty tomentum, varying greatly in length and density. The deliciously fragrant creamy white proterogynous flowers, seven or eight inches across when expanded, continue to open from April or May until July or August. The petaloid sepals and the six or sometimes nine or twelve petals are abruptly unguiculate, oval or ovate, those of the inner rank often somewhat acuminate, concave and coriaceous. They are three or four inches long, and one and a half to two inches broad. The base of the receptacle and lower part of the filaments are bright purple. The fruit is ovate or oval, rusty brown and pubescent, three to four inches long, and one and a half to two and a half inches broad. The seeds are nearly half an inch long, somewhat triangular, often flattened on the face opposite the raphe by mutual pressure.

The northern station of *Magnolia fœtida* is on the coast of North Carolina south of the Cape Fear River. In South Carolina and Georgia it is rarely found more than fifty or sixty miles from the coast; in Florida it extends across the peninsula as far south as Mosquito Inlet on the east coast and the shores of Tampa Bay; it is common in the maritime portions of the Gulf states as far west as the valley of the Brazos River in Texas, extending through western Louisiana to southern Arkansas, and appearing on the bluffs of the lower Mississippi River as far north as the mouth of the Yazoo River in Mississippi.[1] *Magnolia fœtida* flourishes in rich moist soils. Near the coast it is generally confined to the borders of river-swamps and pine-barren ponds; in western Louisiana it is often the characteristic and most conspicuous feature of the forest; and here, and on the rich high rolling hills of the Mississippi bluffs, this tree reaches its greatest development. It is usually found associated with the

[1] *Magnolia Inglefieldi*, the direct ancestor, perhaps, of *M. fœtida*, was common in the Arctic region during the Tertiary period. (Heer, *Fl. Foss. Arct.* vii. 121, t. 69, f. 1, t. 85, f. 3, t. 86, f. 9.)

Swamp Chestnut Oak, the Water Oak, the Willow Oak, the Beech, the Hornbeam, the Black Gum, the Water Gum, the Great Tupelo, and the Liquidamber.

The wood of *Magnolia fœtida* is harder, heavier, and more valuable than that of the other North American Magnolias. The thick sapwood generally consists of seventy to eighty layers of annual growth; it is creamy white, soon turning light brown with exposure, and is not easily distinguished from the rather lighter heartwood. This when perfectly dry has a specific gravity of 0.6360, a cubic foot of the dry wood weighing 39.64 pounds. The wood of this tree is little used except for fuel, although well suited for the finer kinds of cabinet work and the interior finish of houses.

It does not appear who first brought *Magnolia fœtida* to the attention of European botanists. The earliest account, that of Plukenet, was published in his *Amaltheum Botanicum* in 1705.[1] It is not known who first introduced living plants into Europe; a single specimen, said to have been brought from the banks of the Mississippi, was planted near Nantes in 1732;[2] and two years later, according to Aiton,[3] it was cultivated in Sir John Colleton's garden at Exmouth in Devonshire. *Magnolia fœtida* is the most splendid ornamental tree of the North American forests. It is now widely cultivated in the extreme southern states, and has become a striking and beautiful feature in the gardens and streets of many southern cities. It is precariously hardy as far north as Philadelphia. It has been generally introduced into the gardens of temperate Europe and Asia, although in Great Britain often requiring the protection of a wall to insure its blooming.

Several varieties have appeared at different times in European nursery-gardens, especially in those of central and western France, where the propagation of the evergreen Magnolia has been an important industry since its first introduction. These varieties differ principally in the form of the leaf and in the duration of the flowering period. The variety *Exoniensis*,[4] raised in England early in this century, with a rather fastigiate habit of growth, oblong elliptical leaves densely clothed with tomentum on the lower surface, and somewhat contracted flowers, is considered in that country the most distinct, and, from its habit of flowering when only a few feet high, the most valuable for cultivation. The variety *angustifolia*, which appeared at Angers about 1825, is one of the most distinct and permanent of these seminal varieties.[5] The variety *præcox*, another French variety, is distinguished by early and continuous blooming.

[1] *Tulipifera arbor Floridana, lauri longe amplioribus splendentibus et densioribus foliis, flore majore albo*, 206.

Magnolia altissima, flore ingenti candido, Catesby, *Nat. Hist. Car.* ii. t. 61. — Duhamel, *Traité des Arbres*, ii. 1, t. 1.

Magnolia foliis oblongis subtus ferruginiis, flore amplissimo candido, baccis rubellis, Trew, *Pl. Ehret.* 8, t. 33, 35, f. 2.

Magnolia foliis lanceolatis persistentibus, caule erecto arboreo, Miller, *Dict. Icon.* ii. 115, t. 172.

[2] Merlet de la Boulaye, *Nouveau Duhamel*, ii. 220.

[3] *Hort. Kew.* ii. 251.

[4] Loudon, *Arb. Brit.* i. 261. — Loddiges, *Bot. Cab.* t. 814.

[5] Another narrow-leaved form with curiously undulating leaf-margins, of unknown origin, is now found in the gardens of northern Italy under the name of "*Magnolia Hartwegus*."

EXPLANATION OF THE PLATES.

Plate I. Magnolia fœtida.

A flowering branch, natural size.

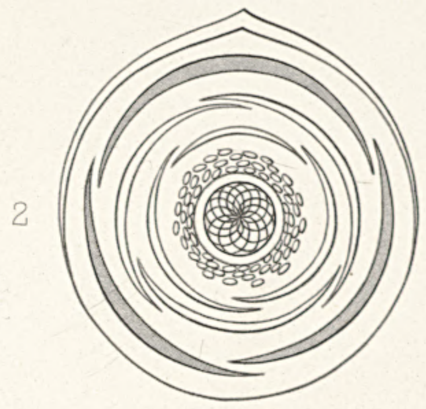
Plate II. Magnolia fœtida.

1. A fruit, natural size.
2. Diagram of the flower.
3. A flower, the calyx and corolla removed, natural size.
4. A stamen, enlarged.
5. Vertical section of the gynœcium, natural size.
6. An ovule, enlarged.
7. Vertical section of a seed, enlarged.
8. A seed, the base of the pulpy portion of the testa removed, showing the stony interior portion, enlarged.
9. A seed, the fleshy part of the testa removed, showing the grooved stony portion, enlarged.
10. Cross section of a seed, enlarged.
11. An embryo, much enlarged.
12. A winter-bud, natural size.

C.E.Faxon del. Picart fr. sc.

MAGNOLIA FŒTIDA, Sarg.

A.Riocreux direx.t Imp.R.Taneur, Paris.



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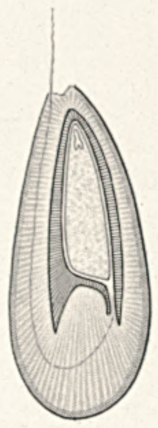

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C. E. Faxon del.

Picart fr. sc.

MAGNOLIA FŒTIDA, Sarg.

A. Riocreux direx.t

Imp. R. Taneur, Paris.

MAGNOLIA GLAUCA.

Sweet Bay. Swamp Bay.

LEAVES subpersistent, pale on the lower surface. Fruit glabrous. Young shoots and winter-buds pubescent.

M. glauca, Linnæus, *Spec.* ed. 2, 755. — Miller, *Dict.* ed. 8. — Marshall, *Arbust. Am.* 83. — Wangenheim, *Nordam. Holz.* 60, t. 19, f. 46. — Walter, *Fl. Car.* 158. — *Icon. Selt. Am. Gewäch.* t. 40. — Lamarck, *Dict.* iii. 674. — Moench, *Meth.* 274. — Willdenow, *Spec.* ii. 1256. — Schkuhr, *Handb.* ii. 1441, t. 148. — Michaux, *Fl. Bor.-Am.* i. 327. — *Nouveau Duhamel*, ii. 223, t. 66. — Desfontaines, *Hist. Arb.* ii. 5. — Bonpland, *Pl. Malm.* 103, t. 42. — Michaux f. *Hist. Arb. Am.* iii. 77, t. 2. — Pursh, *Fl. Am. Sept.* ii. 381. — Bigelow, *Med. Bot.* ii. 67, t. 27; *Fl. Boston.* ed. 3, 244. — Barton, *Med. Bot.* i. 77, t. 7. — Nuttall, *Gen.* ii. 18. — Loddiges, *Bot. Cab.* t. 215. — De Candolle, *Syst.* i. 452; *Prodr.* i. 80. — Hayne, *Dendr. Fl.* 116. — Elliott, *Sk.* ii. 37. — Torrey, *Fl. N. Y.* i. 27, t. 5. — Audubon, *Birds*, t. 118. — Don, *Gen. Syst.* i. 82. — Reichenbach, *Fl. Exot.* v. 37, t. 342. — Torrey & Gray, *Fl. N. Am.* i. 42. — Dietrich, *Syn.* iii. 308. — Spach, *Hist. Veg.* vii. 473. — Loudon, *Arb. Brit.* i. 267, t. — Emerson, *Trees Mass.* ed. 2, ii. 603, t. — Gray, *Gen. Ill.* i. 61, t. 23. — Schnizlein, *Icon.* t. 176. — Darlington, *Fl. Cestr.* ed. 3, 8. — Chapman, *Fl.* 13. — Curtis, *Geolog. Surv. N. Car.* 1860, iii. 66. — Koch, *Dendr.* i. 369. — Sargent, *Forest Trees N. Am. 10th Census U. S.* ix. 19. — Lloyd, *Drugs and Med. N. Am.* ii. 25, t. 28, f. 115. — Watson & Coulter, *Gray's Man.* ed. 6, 49.

M. Virginiana, α. glauca, Linnæus, *Spec.* 535.

M. fragrans, Salisbury, *Prodr.* 379. — Rafinesque, *Fl. Ludovic.* 91; *Med. Bot.* ii. 32.

M. longifolia, Sweet, *Hort. Brit.* 11. — Don, *Gen. Syst.* i. 83. — Dietrich, *Syn.* iii. 308.

M. glauca, var. latifolia, Aiton, *Hort. Kew.* ii. 251. — Pursh, *Fl. Am. Sept.* ii. 381.

M. glauca, var. longifolia, Aiton, *Hort. Kew.* ii. 251. — Pursh, *Fl. Am. Sept.* ii. 381. — Rafinesque, *Fl. Ludovic.* 91. — Hayne, *Dendr. Fl.* 116.

M. glauca, var. pumila, Nuttall, *Am. Jour. Sci.* ser. 1, v. 295.

A slender tree, fifty to seventy feet in height, with a trunk two to three, or, under exceptionally favorable conditions, three and a half feet in diameter; often much smaller, and at the north reduced to a low shrub. The bark of the trunk on fully grown individuals is three eighths to half an inch thick, light brown in color, and covered with small thin appressed scales; that on small trunks and large branches is smooth and light gray. The bark of the slender branchlets, during the first year, is bright green, gradually turning during the second summer to reddish brown. The leaves are oblong or oval, obtuse or sometimes oblong-lanceolate, four to six inches long and one and a half to two and a half inches broad, with a conspicuous midrib and primary veins; they are borne on slender petioles a half to three quarters of an inch long. The leaves are covered, when they first unfold, with long white silky hairs which soon disappear, and at maturity they are bright green and lustrous on the upper surface, which is then quite glabrous and minutely pubescent, pale or nearly white on the lower. They fall, in the northern states, late in November or in early winter, and at the south remain on the branches with little change of color until the appearance of the new leaves in spring. The creamy white fragrant globular flowers, two or three inches across when expanded, continue to open during several weeks in spring and early summer. The sepals are membranaceous, obovate, obtuse, concave, and shorter than the nine to twelve obovate, often unguiculate, concave petals. The dark red fruit is oval, glabrous, two inches long and one and a half inches broad. The seed is a quarter to half an inch long.

Magnolia glauca is found at its most northern limit in swamps in the town of Gloucester in Essex County, Massachusetts. It reappears in a swamp at the north end of Turtle Pond in Suffolk County, Long Island,[1] and extends from New Jersey southward, generally near the coast, to the shores of Bay Biscayne and of Tampa Bay, Florida. It is not found in the Alleghany-mountain region, but abounds in the Gulf states, extending west to southwestern Arkansas and the valley of the Trinity River, Texas.

[1] G. M. Wilbur, *Bull. Torr. Bot. Club*, xii. 87.

Magnolia glauca inhabits at the north, deep wet swamps,[1] where it is associated with the Red Maple, the White Cedar, the High-bush Blueberry, the Andromedas, the Red-berried Prinos, and the Poisonous Sumach; in the south Atlantic and Gulf states it is found along the borders of pine-barren ponds and shallow swamps, where it forms, with the Loblolly Bay and the Red Bay, low, almost impenetrable thickets, reaching its greatest development in the interior of the Florida peninsula on the rich hummocks or islands which rise above the level of the pine-lands.

The wood of *Magnolia glauca* is soft and light. The color of the heartwood, which is found only in old specimens, is light brown tinged with red; the thick sapwood, consisting of ninety to a hundred layers of annual growth, is creamy white, turning darker with exposure. This has, when perfectly dry, a specific gravity of 0.5035, a cubic foot of the dry wood weighing 31.38 pounds. The wood of this tree is now occasionally used in the southern states in the manufacture of broom-handles and other articles of wooden ware.

The earliest mention of *Magnolia glauca* is of "the tree that beareth the rine of blacke Sinamon, of which Master Winter brought from the streights of Magellan," which Philip Amadas and Arthur Barlowe found in 1584 on an island in Pimlico Sound.[2] It was first cultivated in Europe by Bishop Compton,[3] in his garden at Fulham, near London, who received it from John Banister[4] in 1688; and the earliest description is that of Plukenet.[5]

The value of *Magnolia glauca* as an ornamental plant was at once recognized; and it has always been a favorite in gardens where, at different times, several varieties have been distinguished. *Magnolia glauca longifolia*, with lanceolate leaves and a blooming period which sometimes extends through two or three months, is the only one of these that has survived.[6] *Magnolia Thompsoniana*,[7] a probable hybrid between *Magnolia glauca* and *Magnolia tripetala*, raised early in this century by a Mr. Thompson of Mile End in England, has been preserved in gardens, where it is esteemed for its handsome foliage and large and deliciously fragrant flowers.[8]

Magnolia glauca thrives in rich and rather moist soil, and is found to grow more rapidly and vigorously when grafted on *Magnolia acuminata* than it does on its own roots.

[1] *Magnolia glauca*, as the fleshy roots were eaten by beavers, was known to the early settlers in Pennsylvania as Beaver-tree; and beavers, according to Kalm, were caught in traps baited with pieces of the root. (*Travels into North America*, English ed. i. 204.)

[2] First voyage to the coast of Virginia. (Hakluyt, *Voyages*, ed. Evans, iii. 302.)

[3] Henry Compton (1632–38), bishop of London, first cultivated in England many North American plants.

[4] John Banister, a missionary to Virginia, where he died about 1692; author of the first catalogue of North American plants (published in Ray, *Hist. Pl.* ii. 1928). His herbarium is preserved in the British Museum.

[5] *Tulipifera Virginiana, Laurinis foliis, aversa parte rore cæruleo tinctis, Coni-baccifera*, Plukenet, *Alm. Bot.* 379, t. 68, f. 4.

Magnolia lauri folio subtus albicante, Catesby, *Nat. Hist. Car.* i. 39, t. 39. — Duhamel, *Traité des Arbres*, ii. 3. — Trew, *Pl. Ehret.* 2, t. 9. — Dillenius, *Hort. Elth.* 207, t. 168, f. 205.

Magnolia foliis ovato-lanceolatis, Linnæus, *Hort. Cliff.* 222. — Clayton, *Fl. Virgin.* 61.

[6] This variety does not appear to be known in a wild state, and its origin is uncertain. It is, perhaps, the *Magnolia longifolia* of Sweet and of Don (*l. c.*), but as the cultivated plant thrives in New England it can hardly be, as they supposed, a native of Carolina and Georgia; its garden origin seems more probable.

[7] *Bot. Mag.* t. 2164. — Loudon, *Arb. Brit.* i. 267. — Jaume St. Hilaire, *Flore et Pomone*, v. t. 451. — Reichenbach, *Fl. Exot.* v. t. 342. — *Sertum Botanicum*, v. t. — *Garden and Forest*, i. 268, f. 43.

[8] A second supposed hybrid between these species, described by Loudon (*l. c.*) as *Magnolia glauca longifolia*, has now probably disappeared.

EXPLANATION OF THE PLATE.

PLATE III. MAGNOLIA GLAUCA.

1. A flowering branch, natural size.
2. A fruit, natural size.
3. Vertical section of a carpel, enlarged.
4. A stamen, enlarged.
5. Vertical section of a seed, enlarged.
6. A seed, the fleshy part of the testa removed, showing the grooved stony portion, enlarged.
7. Cross section of a seed, enlarged.
8. An embryo, much enlarged.
9. A winter-bud, natural size.

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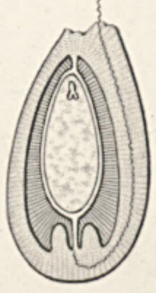
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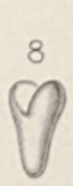
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C.E.Faxon.del. Picart fr. sc.

MAGNOLIA GLAUCA, L.

A.Riocreux direx.t Imp.R.Taneur.Paris.

MAGNOLIA ACUMINATA.

Cucumber Tree. Mountain Magnolia.

LEAVES deciduous, ovate or subcordate. Fruit glabrous. Young shoots and winter-buds densely pubescent.

Magnolia acuminata, Linnæus, *Spec.* ed. 2, 756. — Miller, *Dict.* ed. 8. — Marshall, *Arbust. Am.* 83. — Walter, *Fl. Car.* 159. — Lamarck, *Dict.* iii. 674. — Willdenow, *Spec.* ii. 1257. — Michaux, *Fl. Bor.-Am.* i. 328. — *Nouveau Duhamel*, ii. 222. — Desfontaines, *Hist. Arb.* ii. 5. — Michaux f. *Hist. Arb. Am.* iii. 82, t. 3. — Pursh, *Fl. Am. Sept.* ii. 381. — De Candolle, *Syst.* i. 453; *Prodr.* i. 80. — Loddiges, *Bot. Cab.* t. 418. — Nuttall, *Gen.* ii. 18. — *Bot. Mag.* t. 2427. — Hayne, *Dendr. Fl.* 117. — Elliott, *Sk.* ii. 37. — Guimpel, Otto & Hayne, *Abbild. Holz.* 18, t. 17. — Torrey, *Fl. N. Y.* i. 28. — *Sertum Botanicum*, v. t. — Don, *Gen. Syst.* i. 83. — Reichenbach, *Fl. Exot.* iv. t. 251. — Loudon, *Arb. Brit.* i. 273, t. — Jaume St. Hilaire, *Flore et Pomone*, v. t. 450. — Torrey & Gray, *Fl. N. Am.* i. 43. — Dietrich, *Syn.* iii. 308. — Darlington, *Fl. Cestr.* ed. 3, 9. — Chapman, *Fl.* 14. — Curtis, *Geolog. Surv. N. Car.* 1860, iii. 67. — Baillon, *Hist. Pl.* i. 140. — Koch, *Dendr.* i. 371. — Sargent, *Forest Trees N. Am.* 10*th Census U. S.* ix. 20. — Lloyd, *Drugs and Med. N. Am.* ii. 29, t. 29, f. 116, 117. — Watson & Coulter, *Gray's Man.* ed. 6, 49.

M. Virginiana, ϵ. acuminata, Linnæus, *Spec.* 536.

M. De Candollii, Savi, *Bibl. Ital.* i. 224, t.

Tulipastrum Americanum, Spach, *Hist. Veg.* vii. 483.

A tall slender tree, attaining in its native forests a height of sixty to ninety feet, with a trunk three or four feet in diameter, or, where it finds sufficient room for the development of its lower branches, assuming a broadly pyramidal habit. The bark of the trunk is a third to half an inch thick, furrowed, dark brown, the surface broken into numerous thin scales; that of the slender young branches is bright red-brown, turning gray during their third season. The leaves are membranaceous, oblong, pointed, sometimes rounded or slightly cordate at the base, strengthened by a prominent midrib and primary veins, and borne on slender petioles an inch or an inch and a half long. They are seven to ten inches long and four to six inches broad, and are coated, when they first appear, with white silky hairs which are longest and most abundant on the lower surface. These soon disappear, and at maturity the leaves are glabrous on the upper and slightly pubescent on the lower surface. The bell-shaped glaucous green or pale yellow flowers appear from April to June. The sepals are membranaceous, acute, an inch or an inch and a half long, and soon reflexed. The six petals are obovate, concave, pointed, two and a half to three and a half inches long; those of the outer row rarely more than an inch broad; those of the inner row narrower and often acuminate. The fruit is ovate or oblong, often curved, dark red, two and a half to three inches long, and rarely more than an inch broad.

Magnolia acuminata first appears at the north in western New York; it extends westward through southern Ontario to southern Illinois, and southward on the Appalachian ranges to southern Alabama[1] and northeastern Mississippi.[2] It occurs sparingly in central Kentucky and Tennessee, and reappears west of the Mississippi River in northeastern and in southern and southwestern Arkansas.

Magnolia acuminata is rare at the north, and is nowhere sufficiently common to be a characteristic feature of the forest. It flourishes on the lower slopes of mountains, on the rocky banks of streams, and in narrow valleys, reaching its greatest size and abundance in those about the base of the high mountains of Carolina and Tennessee. Its usual companions in the forest, the Tulip Poplar, the White Oak, the White Ash, the Hickories, and the Sugar Maple, indicate the presence of the generous soil and humid climate essential to its multiplication and best development.

The wood of *Magnolia acuminata* is light, soft, satiny, not strong, but close-grained and durable. It is light yellow-brown in color, and has, when perfectly dry, a specific gravity of 0.4690, a cubic foot

[1] Stockton, C. Mohr.

[2] Meridian, C. Mohr.

of the dry wood weighing 29.23 pounds. The thin sapwood, consisting usually of twenty-five to thirty layers of annual growth, is lighter colored, often nearly white. The rarity of the Cucumber-tree deprives the wood of commercial importance; the trunks, however, were formerly cut for water-pipes and troughs, and are occasionally manufactured into lumber used for flooring and in cabinet-making, for which it is well suited.

Magnolia acuminata was first made known in 1736 by John Clayton.[1] A few years later John Bartram[2] sent plants to Peter Collinson,[3] in whose gardens and in those of Lord Petre[4] it was first cultivated in Europe. The earliest description is that of Catesby.[5]

Magnolia acuminata is now often planted in the United States, and in northern and central Europe. Its habit of retaining its lower branches when it is allowed sufficient room for their development, its rapid growth and handsome foliage and flowers, make it a desirable ornament for the lawn; its pyramidal habit and lofty stem, for the formal plantations of the highway. It has been found that the Magnolias of eastern Asia with precocious flowers, their hybrids, and *Magnolia glauca*, grow more rapidly and make larger and more vigorous plants when they are grafted on *Magnolia acuminata* than they do when grown on their own roots, and it is now often used for this purpose in American nurseries.

Magnolia cordata,[6] a variety of this species, has been cultivated in gardens for nearly a century. It is distinguished by its broader, darker green, and more persistent leaves, sometimes cordate at the base, and by its smaller bright canary-yellow flowers.[7] This tree was probably introduced into Europe by the elder Michaux, but the exact counterpart of the cultivated plant is not known in a wild state.[8] Forms approaching it in the shape and texture of the leaves, and in the size and color of the flowers, are occasionally found, however, on the Blue Ridge in Carolina and in central Alabama.[9]

[1] John Clayton (1686–1773); born at Fulham in England. He emigrated to Virginia in 1705, and is best known by the *Flora Virginica* published in 1739 at Leyden by Gronovius, from specimens and descriptions furnished by Clayton.

[2] John Bartram (1699–1777); the first botanist born in North America, and the founder of the first botanical garden on the continent. Bartram traveled extensively through the eastern part of the country; he was in active correspondence with the principal botanists in Europe, and discovered and introduced many American plants into gardens.

[3] Peter Collinson (1694–1768); a Friend and London woolen-draper, in whose gardens, first at Peckham and then at Mill Hill, many American trees were cultivated in Europe for the first time.

[4] Robert James, eighth Lord Petre (1713–1742); an enthusiastic lover of plants, whose gardens at Thorndon Hall in Essex are thought to have been the finest in England in their day. His early death was described by Collinson as "the greatest loss that botany or gardening ever felt in this island."

[5] *Magnolia flore albo, folio majore acuminato haud albicante, Nat. Hist. Car.* ii. Appx. 15, t. 15. — Clayton, *Fl. Virgin.* 61.

Magnolia foliis ovato-lanceolatis, Linnæus, *Hort. Cliff.* 222.

[6] *Magnolia acuminata*, var. *cordata,* Sargent, *Am. Jour. Sci.* ser. 3, xxxii. 473.

M. cordata, Michaux, *Fl. Bor.-Am.* i. 328. — Poiret, *Lam. Dict.* Suppl. iii. 574. — Michaux f. *Hist. Arb. Am.* iii. 87, t. 4. — Pursh, *Fl. Am. Sept.* ii. 382. — Lindley, *Bot. Reg.* iv. t. 325. — Nuttall, *Gen.* ii. 18. — De Candolle, *Syst.* i. 455; *Prodr.* i. 80. — Hayne, *Dendr. Fl.* 118. — Elliott, *Sk.* ii. 38. — Loddiges, *Bot. Cab.* t. 474. — *Sertum Botanicum*, v. t. — Don, *Gen. Syst.* i. 83. — Reichenbach, *Fl. Exot.* iv. t. 250. — Loudon, *Arb. Brit.* i. 275, t. — Jaume St. Hilaire, *Flore et Pomone*, v. t. 452. — Torrey & Gray, *Fl. N. Am.* i. 43. — Chapman, *Fl.* 14. — Curtis, *Geolog. Surv. N. Car.* 1860, iii. 68. — Koch, *Dendr.* i. 371. — Lloyd, *Drugs and Med. N. Am.* ii. 37.

Tulipastrum Americanum, var. *subcordatum*, Spach, *Hist. Veg.* vii. 483.

[7] Michaux's specimen upon which Richard founded his *M. cordata*, preserved in the *Muséum d'Histoire Naturelle* in Paris, represents a common form of *M. acuminata.*

[8] According to Aiton (*Hort. Kew.* ed. 2, iii. 331), *M. cordata* was introduced into England in 1801 by John Fraser, a Scotchman who traveled in North America between 1780 and 1810, and sent many American plants to Europe (*Comp. Bot. Mag.* ii. 300).

[9] Our figure is made from specimens taken from one of the two trees in the botanic garden of Harvard University, which were imported from Europe, probably not long after the garden was established in 1805.

EXPLANATION OF THE PLATES.

Plate IV. Magnolia acuminata.

A flowering branch, natural size.

Plate V. Magnolia acuminata.

1. A fruiting branch, natural size.
2. A flower, the calyx and corolla removed, natural size.
3. Vertical section of the gynœcium, enlarged.
4. A stamen, enlarged.
5. Vertical section of a seed, enlarged.
6. A seed, the base of the pulpy portion of the testa removed, showing the stony interior portion, enlarged.
7. Cross section of a seed, enlarged.
8. A seed, the fleshy part of the testa removed, showing the grooved stony portion, enlarged.
9. An embryo, much enlarged.
10. A winter-bud, natural size.

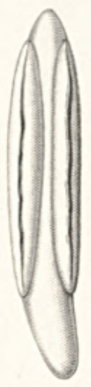
Plate VI. Magnolia acuminata, var. cordata.

1. A flowering branch, natural size.
2. A fruiting branch, natural size.
3. Vertical section of a carpel, enlarged.
4. A stamen, enlarged.
5. A seed, natural size.
6. Vertical section of a seed, enlarged.
7. An embryo, much enlarged.
8. A winter-bud, natural size.

C.E.Faxon del. Picart fr. sc.

MAGNOLIA ACUMINATA, L.

A. Riocreux direx.t Imp. R. Taneur, Paris.



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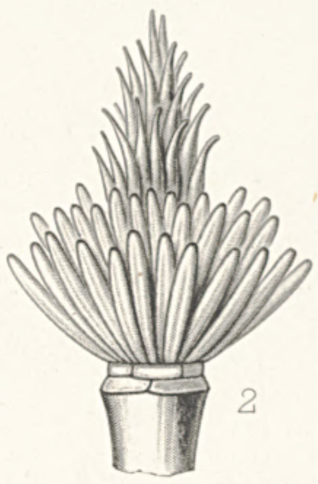

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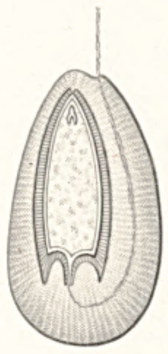

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C.E.Faxon del.

Picart fr. sc.

MAGNOLIA ACUMINATA, L.

A.Riocreux direx.t

Imp.R.Taneur.Paris.

C.E.Faxon del. Picart fr. sc.

MAGNOLIA ACUMINATA, Var. CORDATA, Sarg.

A. Riocreux direx.t Imp. R. Taneur, Paris.

MAGNOLIA MACROPHYLLA.

Large Leaved Cucumber Tree.

LEAVES deciduous, obovate or oblong, cordate at the narrow base. Pistils woolly. Fruit and young shoots pubescent. Winter-buds covered with thick silky white hairs.

Magnolia macrophylla, Michaux, *Fl. Bor.-Am.* i. 327. — *Nouveau Duhamel*, ii. 221. — Desfontaines, *Hist. Arb.* ii. 5. — Michaux f. *Hist. Arb. Am.* iii. 99, t. 7. — Bonpland, *Pl. Malm.* 84, t. 33. — Pursh, *Fl. Am. Sept.* ii. 381. — Nuttall, *Gen.* ii. 18; *Sylva*, i. 83. — De Candolle, *Syst.* i. 454; *Prodr.* i. 80. — *Bot. Mag.* t. 2189. — Hayne, *Dendr. Fl.* 117. — Elliott, *Sk.* ii. 40. — Rafinesque, *Med. Bot.* ii. 31, t. 62. — *Sertum Botanicum*, v. t. — Don, *Gen. Syst.* i. 83. — Reichenbach, *Fl. Exot.* 44, t. 139. — Loudon, *Arb. Brit.* i. 271, t. — Torrey & Gray, *Fl. N. Am.* i. 43. — Dietrich, *Syn.* iii. 308. — Spach, *Hist. Veg.* vii. 479. — Griffith, *Med. Bot.* 98, f. 57. — Chapman, *Fl.* 14. — Curtis, *Geolog. Surv. N. Car.* 1860, iii. 67. — Koch, *Dendr.* i. 374. — Sargent, *Forest Trees N. Am.* 10*th Census U. S.* ix. 21. — Lloyd, *Drugs and Med. N. Am.* ii. 38, t. 30. — Watson & Coulter, *Gray's Man.* ed. 6, 119.

A spreading tree, thirty to fifty feet high, with a straight trunk which sometimes attains, under favorable conditions, a diameter of eighteen or twenty inches. The bark of the trunk on old trees is thin, generally less than a quarter of an inch thick, the surface divided into minute scales, smooth and light gray in color. The bark of the stout brittle branchlets is green, turning reddish brown during the second, and becoming gray during the third season. The leaves are membranaceous, obovate or oblong, narrowed and cordate at the base, strengthened by a prominent midrib and primary veins, and borne on stout petioles three or four inches long. They are often twenty to thirty inches long or more, and nine or ten inches broad, and are bright green and glabrous on the upper surface, silvery gray and slightly pubescent, especially along the midrib, on the lower surface. The great creamy white cup-shaped fragrant flowers, ten or twelve inches across when expanded, appear in May and June. The sepals are membranaceous, ovate or oblong, rounded at the end, five to six inches long, and much narrower than the six ovate concave petals which are six or seven inches long and three or four inches broad, those of the inner row being narrower and often somewhat acuminate. They are thick, creamy white, marked on the interior surface near the base with a small rose-colored spot, and at maturity are reflexed above the middle. The fruit is broadly ovate, or often nearly round, two and a half or three inches long, and when fully ripe bright rose-colored. The seeds are two thirds of an inch long, often flattened on the face opposite the raphe.

Magnolia macrophylla is found in the region about the base of the southern Alleghany Mountains, from North Carolina and southeastern Kentucky to middle and western Florida and southern Alabama; it extends through northern Mississippi to the valley of the Pearl River in Louisiana; and west of the Mississippi River it occurs in central Arkansas in Garland, Montgomery, Hot Springs, and Sebastian counties.

Magnolia macrophylla inhabits sheltered valleys in deep rich soil, protected from the wind by the forest of Swamp Chestnut Oaks, Gum-trees, Hickories, and Dogwoods, which are usually associated with it. It is nowhere a common tree, growing generally in isolated groups of a few individuals. In the Atlantic states it has been found in a few widely separated regions only; west of the mountains it is more abundant, reaching its best development in the limestone valleys of northern Alabama.

The wood of *Magnolia macrophylla* is hard and close-grained, but light and not strong. It is light brown in color, and has, when perfectly dry, a specific gravity of 0.5309, a cubic foot of the dry wood weighing 33.09 pounds. The thick sapwood, consisting of about forty layers of annual growth, is light yellow.

Magnolia macrophylla was discovered by the elder Michaux in June, 1789, near Charlotte, North Carolina.[1] It was introduced into European gardens in 1800; but it has never become widely distributed in them or in those of the United States, although few trees equal it in beauty. The flowers and the leaves are the largest of any species of the genus, and they are larger and more conspicuous than those produced by any other tree of the North American forests. *Magnolia macrophylla* is hardy as far north as eastern Massachusetts. It requires no special care in cultivation, and young plants begin to flower when they are only a few years old.

[1] Michaux, *Jour.* in *Proc. Am. Phil. Soc.* xxvi. 53, 61. In his *Flora* Michaux makes no reference to the Carolina station, and *Magnolia macrophylla* is credited to the region west of the mountains.

EXPLANATION OF THE PLATES.

PLATE VII. MAGNOLIA MACROPHYLLA.

A flowering branch, natural size.

PLATE VIII. MAGNOLIA MACROPHYLLA.

1. A fruit, natural size.
2. Vertical section of the gynœcium, enlarged.
3. A stamen, enlarged.
4. A seed, the base of the pulpy portion of the testa removed, showing the stony interior portion, enlarged.
5. A seed, the fleshy part of the testa removed, enlarged.
6. Vertical section of a seed, enlarged.
7. Cross section of a seed, enlarged.
8. An embryo, much enlarged.
9. A winter-bud, natural size, the outer scale expanded.
10. Cross section of a winter-bud, enlarged.

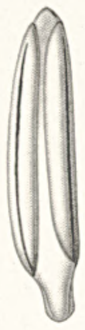
C.E.Faxon del.

MAGNOLIA MACROPHYLLA, Michx.

A.Riocreux direx.t

Imp.R.Taneur, Paris.

Picart fr. so.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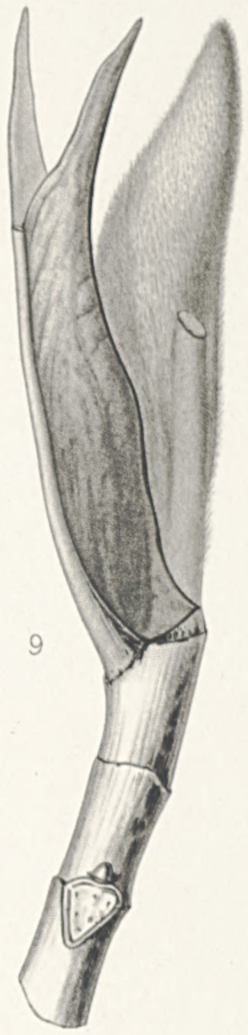
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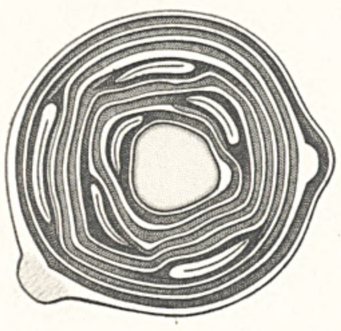
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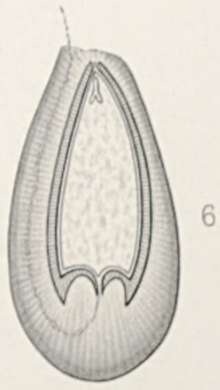
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C.E. Faxon, del. *Picart fr. sc.*

MAGNOLIA MACROPHYLLA, Michx.

A. Riocreux direx.t *Imp. R. Taneur, Paris.*

MAGNOLIA TRIPETALA.

Umbrella Tree. Elk Wood.

LEAVES obovate-lanceolate. Fruit and winter-buds glabrous.

Magnolia tripetala, Linnæus, *Spec.* ed. 2, 756. — Miller, *Dict.* ed. 8. — Marshall, *Arbust. Am.* 84. — Walter, *Fl. Car.* 159. — Willdenow, *Spec.* ii. 1258. — Michaux, *Fl. Bor.-Am.* i. 327. — Desfontaines, *Hist. Arb.* ii. 5. — Michaux f. *Hist. Arb. Am.* iii. 90, t. 5. — Pursh, *Fl. Am. Sept.* ii. 381. — Nuttall, *Gen.* ii. 18. — Guimpel, Otto & Hayne, *Abbild. Holz.* 20, t. 18. — Hayne, *Dendr. Fl.* 116. — Elliott, *Sk.* ii. 38. — Loudon, *Arb. Brit.* i. 269, t. — Jaume St. Hilaire, *Flore et Pomone*, v. t. 449. — Koch, *Dendr.* i. 370.

M. Virginiana, δ. tripetala, Linnæus, *Spec.* 536.

M. Umbrella, Lamarck, *Dict.* iii. 673. — *Nouveau Duhamel*, ii. 221. — De Candolle, *Syst.* i. 452; *Prodr.* i. 80. — Loiseleur, *Herb. Amat.* iii. t. 198. — Don, *Gen. Syst.* i. 83. — Torrey & Gray, *Fl. N. Am.* i. 43. — Dietrich, *Syn.* iii. 308. — Spach, *Hist. Veg.* vii. 475. — Gray, *Gen. Ill.* i. 62, t. 24; *Jour. Linn. Soc.* ii. 106, f. 1–18. — Chapman, *Fl.* 13. — Curtis, *Geolog. Surv. N. Car.* 1860, iii. 67. — Sargent, *Forest Trees N. Am. 10th Census U. S.* ix. 21. — Watson & Coulter, *Gray's Man.* ed. 6, 49.

M. frondosa, Salisbury, *Prodr.* 379.

A small tree, thirty to forty feet high, with a straight or often inclining trunk rarely more than eighteen inches in diameter, generally much smaller, and sometimes surrounded by several stems springing from its base and growing into a large bush surmounted by the head of the principal trunk. The branches are often developed irregularly; they are contorted, or are wide-spreading nearly at right angles with the stem, or turn up towards the extremities and then grow parallel with it. The bark on old trunks and branches is half an inch thick, light gray, smooth, and marked with numerous small blister-like excrescences; that of the stout brittle branches is green during the first year, turning brown during the second, and gray during the third season. The large winter-buds are purple and covered with a glaucous bloom. The leaves are membranaceous, bright green, obovate-lanceolate, pointed at both ends, and covered on the lower surface, when they first appear, with a thick silky tomentum. They are quite glabrous at maturity, and are then eighteen or twenty inches long and eight or ten inches broad, with a short stout petiole an inch and a half long, and a prominent midrib. The creamy white flowers, four or five inches deep, appear during the month of May and exhale a strong disagreeable odor. The sepals are narrowly obovate, five or six inches long, one and a half inches broad, thin, light green, and reflexed. The six or nine petals are concave, coriaceous, ovate-unguiculate; those of the outer row are four or five inches long and sometimes two inches broad, those of the inner rows being shorter and much narrower. The filaments are bright purple. The fruit is ovate, two and a half to four inches long, and bright rose-colored when fully ripe.

Magnolia tripetala is widely distributed in all the Alleghany-mountain region from southern Pennsylvania to central Alabama, extending in the south Atlantic states nearly to the coast, and west of the mountains to middle Kentucky and Tennessee and northeastern Mississippi, reappearing beyond the Mississippi River in central and southwestern Arkansas.

Magnolia tripetala is nowhere common. It grows naturally only in deep and rather moist rich soil. It occupies the banks of mountain streams, springing from masses of the Great Rhododendron, or is found on the margins of the great swamps which extend along the rivers in the middle districts where it is shaded by forests of the Swamp Chestnut Oak, the Scarlet Maple, and the different Gum-trees, and reaches its greatest size in the valleys which extend from the western slopes of the Great Smoky Mountains in Tennessee.

The wood of *Magnolia tripetala* is light, soft, close-grained, but not strong. The heartwood is

brown and has, when perfectly dry, a specific gravity of 0.4487, a cubic foot of the dry wood weighing 27.96 pounds. The rather heavier sapwood, consisting of thirty-five to forty layers of annual growth, is creamy white.

Magnolia tripetala was first described by Catesby in his *Natural History of Carolina*, published in 1743,[1] and was introduced into the gardens of Europe as early as 1752.[2] The arrangement of the leaves at the end of the branches, resembling somewhat that of the ribs of an umbrella, led the early settlers in Virginia and Carolina to call this Magnolia the Parasol-tree, or Umbrella-tree;[3] and the specific name, *Umbrella*, was given to it by Lamarck, who discarded the older Linnæan name referring to the three conspicuous reflexed petaloid sepals. Such a change, in spite of the technical inaccuracy of the name, is contrary to the modern ideas of botanical nomenclature, however, and the Linnæan *tripetala* is now generally adopted. The hardiness of the Umbrella-tree, its ample foliage, large flowers, and brilliant and conspicuous fruit, have made it a favorite in gardens and parks, in spite of its small size and sprawling habit; and it is one of the most commonly cultivated of the American Magnolias in the northern United States, and in northern and central Europe. It is often used in American nurseries as stock upon which to propagate the less vigorous species. It grows in cultivation with rapidity and vigor, and is hardy as far north as New England.

[1] *Magnolia amplissimo flore albo, fructu coccineo*, ii. 80, t. 80.

Magnolia flore maximo albo fœtido, foliis deciduis amplis, florem ad ramulorum seriem sphærice cingentibus, fructu majori, Clayton, *Fl. Virgin.* 61.

Magnolia foliis ovato-oblongis, ad basin et apicem angustis, utrinque virentibus, Pl. Ehrh. 30, t. 62, 63.

[2] Aiton, *Hort. Kew.* ii. 252. — Loudon, *Arb. Brit.* i. 269.

[3] Catesby, *l. c.*

EXPLANATION OF THE PLATES.

Plate IX. Magnolia tripetala.

A flowering branch, natural size.

Plate X. Magnolia tripetala.

1. A fruit, natural size.
2. A flower, the calyx and corolla removed, natural size.
3. A stamen, posterior view, enlarged.
4. A stamen, anterior view, enlarged.
5. Vertical section of the gynœcium, enlarged.
6. A carpel laid open, enlarged.
7. Vertical section of a seed, enlarged.
8. Cross section of a seed, enlarged.
9. A seed, the fleshy part of the testa removed, showing the grooved stony portion, enlarged.
10. An embryo, much enlarged.
11. A winter-bud, the outer scale removed, natural size.

C.E.Faxon del.

Picart fr. sc.

MAGNOLIA TRIPETALA, L.

A.Riocreux direx.t

Imp.R.Taneur, Paris.

C.E.Faxon. del.

Picart fr. sc.

MAGNOLIA TRIPETALA, L.

A. Riocreux direx.t

Imp.R.Taneur, Paris.

MAGNOLIA FRASERI.

Mountain Magnolia. Long Leaved Cucumber Tree.

LEAVES obovate-spatulate, auriculate at the base. Point of the carpel of fruit long and recurved.

Magnolia Fraseri, Walter, *Fl. Car.* 159, t. — Torrey & Gray, *Fl. N. Am.* i. 43. — Dietrich, *Syn.* iii. 308. — Chapman, *Fl.* 14. — Curtis, *Geolog. Surv. N. Car.* 1860, iii. 68. — Koch, *Dendr.* i. 372. — Sargent, *Forest Trees N. Am.* 10*th Census U. S.* ix. 22. — Watson & Coulter, *Gray's Man.* ed. 6, 50.

M. auriculata, Lamarck, *Dict.* iii. 673. — Bartram, *Trav.* 339. — Willdenow, *Spec.* ii. 1258. — Michaux, *Fl. Bor.-Am.* i. 328. — *Nouveau Duhamel*, ii. 222. — Desfontaines, *Hist. Arb.* ii. 5. — Michaux f. *Hist. Arb. Am.* iii. 94, t. 6. — Andrews, *Bot. Rep.* ix. t. 573. — *Bot. Mag.* t. 1206. — Cubières, *Mém. Magn.* t. — Pursh, *Fl. Am. Sept.* ii. 382. — Nuttall, *Gen.* ii. 18. — De Candolle, *Syst.* i. 454; *Prodr.* i. 80. — Hayne, *Dendr. Fl.* 117. — Elliott, *Sk.* ii. 39. — Rafinesque, *Med. Bot.* ii. 32. — Audubon, *Birds*, t. 38. — Don, *Gen. Syst.* i. 83. — Spach, *Hist. Veg.* vii. 477. — Loudon, *Arb. Brit.* i. 276, t. — Jaume St. Hilaire, *Flore et Pomone*, v. t. 453.

M. pyramidata, Pursh, *Fl. Am. Sept.* ii. 382. — De Candolle, *Syst.* i. 454; *Prodr.* i. 80. — Hayne, *Dendr. Fl.* 117. — Lindley, *Bot. Reg.* v. t. 407. — Loddiges, *Bot. Cab.* t. 1092. — Rafinesque, *Med. Bot.* ii. 33. — Don, *Gen. Syst.* i. 83. — Loudon, *Arb. Brit.* i. 277, t. — Seringe, *Fl. Jard.* iii. 230.

M. auricularis, Salisbury, *Parad. Lond.* i. t. 43. — Kerner, *Hort.* t. 360.

A tree, thirty to forty feet high, with a straight or inclining trunk twelve or eighteen inches in diameter, often undivided for half its length or separated at the ground into a number of stout shrub-like diverging stems. The branches are regular and wide-spreading, or they are contorted or turned up towards the extremity. The bark of the trunk rarely exceeds a third of an inch in thickness; it is dark brown, smooth, covered with small excrescences, or on old individuals broken into minute scales. The bark of the stout brittle branchlets is bright red-brown, turning gray during their third season, and marked with numerous small white dots. The large winter-buds are purple. The leaves are membranaceous, obovate-spatulate, pointed, cordate and conspicuously auriculate at the base, and borne on slender petioles three or four inches long. They are bright green, often marked on the upper surface, when young, with red along the principal veins, glabrous, ten or twelve inches long and six or seven inches broad, or, on vigorous young plants, sometimes twice that size. The creamy white sweetly scented flowers, eight or nine inches across when expanded, appear in May or June. The sepals, which fall almost immediately after the opening of the bud, are narrowly obovate, rounded at the extremity, four or five inches long, and shorter than the six or nine obovate acuminate membranaceous spreading petals, which are contracted below the middle, those of the inner rows being narrower and conspicuously unguiculate. The fruit is oblong, four or five inches in length, one and a half to two inches broad, bright rose-red when fully ripe, and distinguished by the long persistent subulate points crowning the carpels, which are bright yellow on the inner surface.

Magnolia Fraseri is the least widely distributed of the American Magnolias. The northern limit of its range is in the mountains of southwestern Virginia; it extends southward to the valley of the Chattahoochee River in western Florida, and to southern Alabama, and westward through east Tennessee and northern Mississippi to the valley of the Pearl River. It grows in great abundance on the lower slopes of the high Alleghany Mountains, and of the Blue Ridge in North and South Carolina at an elevation of two to three thousand feet above the sea-level; while at lower elevations and remote from the mountains it is found only occasionally in isolated situations. Its real home is in the valleys of the mountain streams which flow from the Blue Ridge to form the principal tributaries of the Savannah, and from the slopes of the Black and the Big Smoky Mountains. It is a conspicuous feature in these

valleys, growing with Black Oaks and White Oaks, Hickories, the Black Birch, the Buckeye, the Sorrel-tree, the Cucumber-tree, and the Yellow Poplar.

The wood of *Magnolia Fraseri* is light, soft, close-grained, but not strong. The thick creamy white sapwood, consisting of thirty to forty layers of annual growth, has, when perfectly dry, a specific gravity of 0.5003, a cubic foot of the dry wood weighing 31.18 pounds. The heartwood, which appears in large specimens only, is light brown.

Magnolia Fraseri was discovered by William Bartram[1] in May, 1776, on the headwaters of the Keowee in South Carolina. It was introduced by Bartram into England ten years later, and was sent by the elder Michaux[2] to France in 1789. The oldest specific name bestowed upon this tree commemorates the services of John Fraser, who shares with Bartram the honor of having introduced it into gardens.

Magnolia Fraseri is rarely found in cultivation. It is not generally a robust or vigorous plant when removed from the humid climate and rich soil in which it naturally grows, and it is less easily propagated than the other American Magnolias. In New England it is only precariously hardy.

[1] William Bartram (1739–1823), a son of John Bartram, and the first botanist to explore the high Alleghany Mountains, in which he made many interesting discoveries. He is remembered by his *Travels through North and South Carolina, Georgia, East and West Florida, the Cherokee country, etc.*, published in Philadelphia in 1791.

[2] Michaux, *Jour.* in *Proc. Am. Phil. Soc.* xxvi. 46.

EXPLANATION OF THE PLATES.

Plate XI. Magnolia Fraseri.

A flowering branch, natural size.

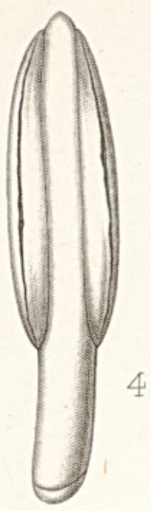
Plate XII. Magnolia Fraseri.

1. A fruit, natural size.
2. A flower, the calyx and corolla removed, natural size.
3. Vertical section of the same, enlarged.
4. A stamen, posterior view, enlarged.
5. A stamen, anterior view, enlarged.
6. Vertical section of a carpel, enlarged.
7. Vertical section of a seed, enlarged.
8. Cross section of a seed, enlarged.
9. A seed, the base of the pulpy portion of the testa removed, showing the stony interior portion, enlarged.
10. A seed, the fleshy part of the testa removed, showing the grooved stony portion, enlarged.
11. An embryo, much enlarged.
12. A winter-bud, natural size.

C.E.Faxon del. Picart fr. sc.

MAGNOLIA FRASERI, Walt.

A. Riocreux direct.t Imp.R.Taneur, Paris.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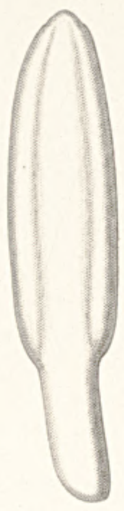
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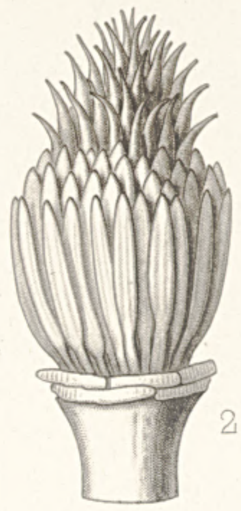
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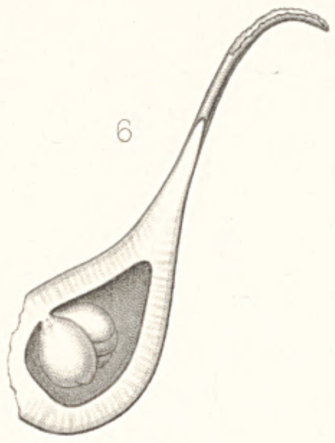
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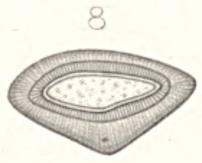
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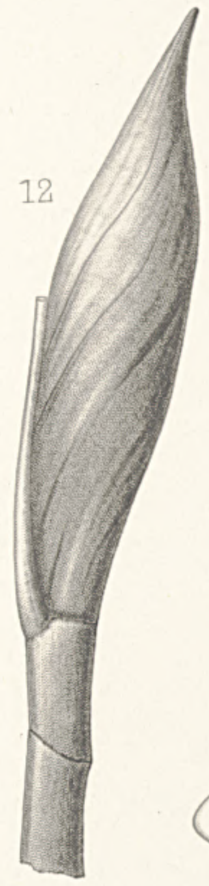
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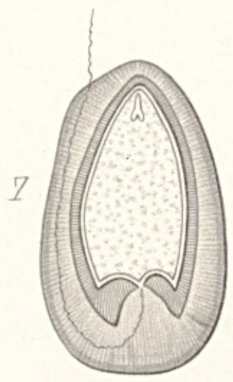
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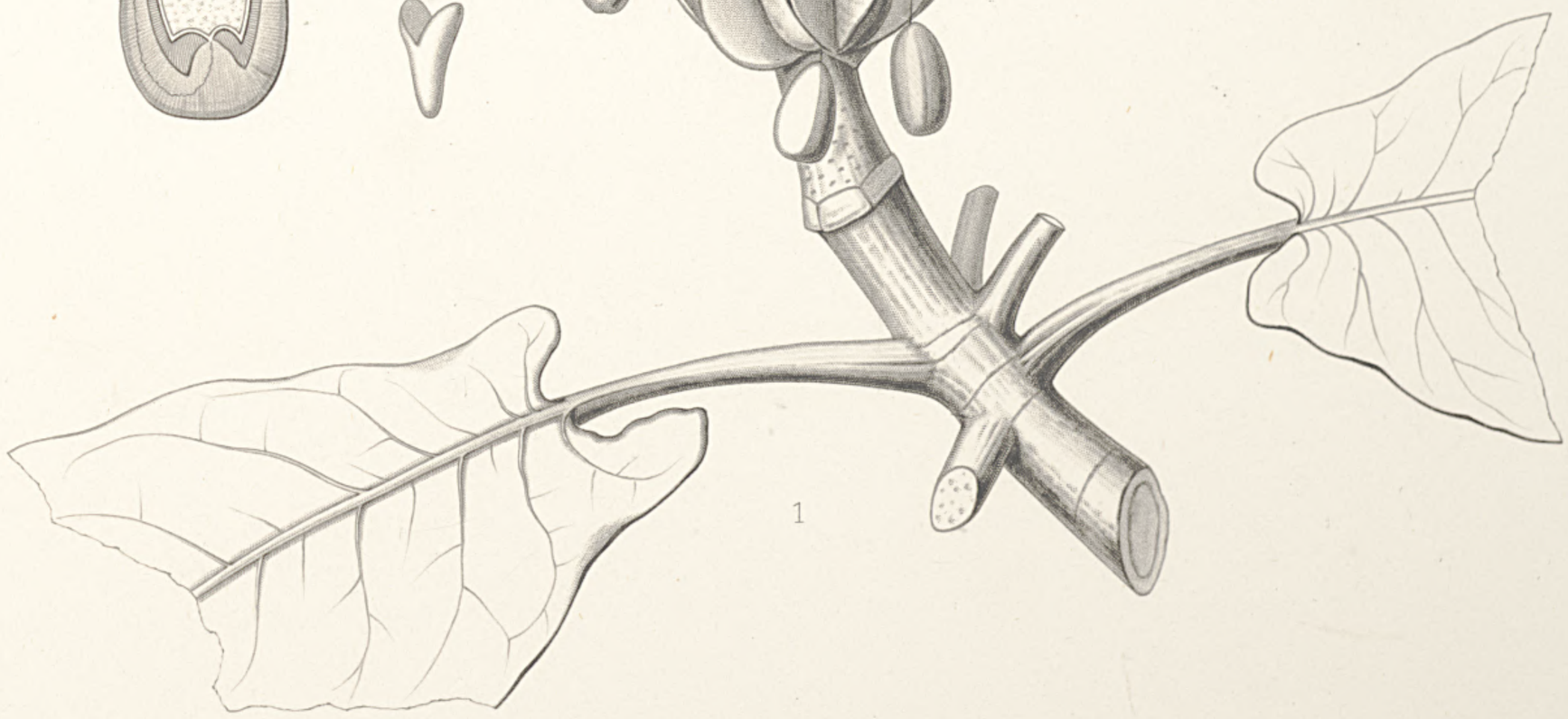
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C.E.Faxon del. *Picart fr. sc.*

MAGNOLIA FRASERI, Walt.

A.Riocreux direx.t *Imp.R.Taneur, Paris.*

LIRIODENDRON.

FLOWER-BUD inclosed in a two-valved stipular caducous spathe. Flowers perfect, solitary, terminal; sepals 3; petals 6, in two rows; anthers extrorse; pistils indefinite, imbricated. Carpels samaræform, indehiscent, deciduous from the receptacle at maturity.

Liriodendron, Linnæus, *Gen.* Suppl. 9. — A. L. de Jussieu, *Gen.* 281. — Endlicher, *Gen.* 838. — Meisner, *Gen.* 3. — Gray, *Gen. Ill.* i. 63, t. 25. — Bentham & Hooker, *Gen.* i. 19. — Baillon, *Hist. Pl.* i. 188.

Tulipifera, Adanson, *Fam. Pl.* ii. 365.

A tree, with fleshy roots, deeply furrowed brown bitter bark, and branchlets marked by round leaf-scars and narrow stipular rings. Buds compressed, obtuse, their scales membranaceous stipules joined at the edges, tardily deciduous[1] after the unfolding of the leaf, which is recurved in vernation by the bending down of the petiole near the middle, bringing the apex of the conduplicate blade to the base of the bud.[2] Leaves alternate, smooth, long-petioled, feather-veined, sinuately four-lobed, heart-shaped, truncate or slightly wedge-shaped at the base, the extremity truncate by a broad shallow sinus minutely apiculate.[3] Flowers pedunculate, cup-shaped, conspicuous; spathe membranaceous. Sepals imbricated in the bud, spreading or reflexed, ovate-lanceolate, concave, greenish white, early-deciduous. Petals imbricated in the bud, hypogynous, erect, broadly ovate, rounded at the extremity, light green, reticulate-veined, marked with orange at the base, deciduous. Stamens indefinite, imbricated in many ranks upon the base of the receptacle, two thirds the length of the petals, deciduous; filaments filiform, half the length of the elongated linear two-celled anthers adnate to the outer face of the connective, the contiguous cells opening longitudinally. Pistils densely imbricated on the elongated sessile receptacle into a spindle-shaped column; ovary inserted by a broad face, one-celled; style narrowly acuminate, laterally flattened, appressed; stigma short, unilateral, recurved at the summit; ovules two, collateral, suspended from near the middle of the ventral suture, anatropous. Fruit a narrow light brown cone formed of the closely imbricated carpels, which fall when ripe from the slender elongated axis persistent during winter.[4] Carpels dry and woody, indehiscent, consisting of a laterally compressed four-ribbed pericarp, the lateral ribs confluent into the margins of the large wing-like lanceolate compressed style marked vertically with a thin sutural line. Seeds suspended, two, or single by abortion; testa thin, dry, coriaceous, and marked with the narrow prominent raphe. Embryo minute, at the base of the fleshy albumen, its radicle next the hilum.

The genus Liriodendron, with a single species, is found in eastern North America and western China.[5] It was represented by several species in the Cretaceous age, when the genus was widely distributed in North America and Europe. It continued to exist during the Tertiary period, with a species,[6]

[1] The stipules generally do not fall until the leaf is fully grown, and sometimes remain on vigorous shoots until the end of summer.

[2] Mirbel, *Elémens de Physiologie et de Botanique*, t. 20. — Trécul, *Ann. Sci. Nat.* ser. 3, xx. 296.

[3] This minute point is the extremity of the midrib prolonged without cellular tissue beyond the leaf-blade. (Godron, *Observations sur les Bourgeons et sur les Feuilles du Liriodendron Tulipifera*, *Bull. Soc. Bot. France*, viii. 33, t. 1.)

[4] The carpels of the outer rows are almost always sterile, and often remain attached to the axis during the winter, giving to the naked branches the appearance of terminating in brown tulip-shaped flowers.

[5] The Tulip-tree was discovered in China in 1875. The specimens gathered on the mountains near Kiukiang were first supposed to belong to a distinct species (Le Marchant Moore, *Jour. Bot.* 1875, 225); later it was collected again in the same district by Maries, and the Chinese plant was considered a variety of the American species, or the American species itself introduced and naturalized in China. (Hemsley, *Jour. Linn. Soc.* xxiii. 25; *Garden and Forest*, ii. 123.) Dr. A. Henry found the Tulip-tree abundant and growing spontaneously on the mountains north and south of the Yang-tse River in the district of Hupeh, and his specimens received in England in 1889 lead Mr. W. Botting Hemsley to pronounce the Chinese tree identical with the North American species. (*Gard. Chron.* 3d ser. vi. 718, December 21, 1889.)

[6] *Liriodendron Procaccinii*, Unger, *Gen. et Spec. Pl. Foss.* 443.

hardly different from the one now living, extending over eastern North America, and Europe as far south as Italy,[1] until the advent of glacial ice destroyed it in Europe, and restricted its range in America to the shores of the Gulf of Mexico.

The wood of Liriodendron is light and soft, brittle and not strong; it possesses a close straight grain;[2] it is readily worked, and does not easily split or shrink; the numerous medullary rays are thin and inconspicuous. The color of the heartwood is light yellow or brown, with a specific gravity, when absolutely dry, of 0.4230, a cubic foot of the dry wood weighing 26.36 pounds. The thin sapwood, which varies in the number of layers of annual growth in different individuals, is relatively thin and creamy white. The wood of Liriodendron, known as yellow poplar and as whitewood, is one of the most valuable products of the American forest. Canoes made from it were used by the aborigines when this country was first visited by Europeans,[3] and ever since, it has been largely manufactured into lumber used in construction,[4] in the interior finish of houses, in boat-building, and for shingles, pumps, and wooden ware.[5]

All parts of Liriodendron are bitter and slightly aromatic. The inner bark, especially of the root, is intensely acrid and bitter, and has long been used domestically in the United States as a tonic and stimulant.[6] Hydrochlorate of tulipiferine, an alkaloid recently separated from the bark of Liriodendron, possesses the power of stimulating the action of the heart.[7]

No vitally destructive insects are known to prey upon Liriodendron. Larvæ of a small moth (*Phyllocnistis liriodendrella*)[8] make long linear channels through the leaves. The foliage is occasionally disfigured by a dipterous insect[9] which, when abundant, covers the leaves with small brownish spots, causing them to become dry and fall from the branches; an aphis (*Siphonophora liriodendri*)[10] sometimes blackens the foliage, and a scale (*Lecanium tulipiferæ*),[11] found upon the bark of the branches, injures the trees in the western states.

The earliest generic name of the Tulip-tree, Tulipifera, was published by Paul Hermann in 1687,[12] and was adopted by Linnæus as his specific name for this tree. The Linnæan generic name (λίριον and δένδρον) is descriptive of the lily-like or tulip-like flower.

[1] Massalongo, *Fl. Senog.* 311, t. 7, f. 23, t. 39, f. 3–6.

[2] Individual trees are occasionally found with the grain of the wood beautifully curled or contorted. The wood of such trees is valued highly for cabinet-making.

[3] "Rakiock, a kind of trees so called that are sweet wood of which the inhabitans that were neere unto us doe commonly make their boats or Canoes of the form of trowes." (*A briefe and true report of the new found land of Virginia*, 23, Thomas Hariot.) Pickering (*Chron. Hist. Pl.* 909) considers, probably correctly, that Rakiock was the Tulip-tree. The methods used by the aborigines of Virginia in felling trees and shaping their canoes with the aid of fire are described and illustrated in Appendix XII. to Hariot's narrative.

Canoe-tree was once a common name for Liriodendron among the early settlers in Virginia and Pennsylvania.

[4] Kalm, *Travels into North America*, English ed. i. 202.

[5] Lumbermen recognize varieties of yellow poplar, differing slightly in color and in the amount of sapwood, and believe that such varieties can be distinguished by the shape of the leaves and by the habit of the individual trees which produce them. Such characters, if they exist, are certainly not constant, and bear no apparent relation to the nature of the wood, determined probably by the soil in which the individual tree has grown.

[6] Lloyd, *Drugs and Med. N. Am.* ii. 12.

[7] Lloyd, *l. c.* 18.

[8] *Bull. Hayden's U. S. Geolog. Surv.* 1878, iv. 108.

[9] *Cecidomyia liriodendri*, Osten-Sacken, *Monog. Diptera, N. Am.* i. 202. — J. G. Jack, *Garden and Forest*, ii. 605, f. 152.

[10] *Bull. Hayden's U. S. Geolog. Surv.* 1878–80, v. 20.

[11] Cook, *American Naturalist*, xiii. 324.

[12] *Tulipifera arbor Virginiana, Cat. Hort. Lugd. Bat.* 612, t.

Tulipifera Caroliniana foliis productioribus magis angulosis, Plukenet, *Phyt.* t. 68, f. 3.

Tulipifera Virginiana tripartito Aceris folio media laciniata, velut abscissa, Plukenet, *Alm. Bot.* 379, t. 117, f. 5, t. 248, f. 7. — Ray, *Hist. Pl.* ii. 1798. — Duhamel, *Traité des Arbres*, ii. 347, t. 102. — Catesby, *Nat. Hist. Car.* i. 48, t. 48.

Liriodendrum, Linnæus, *Hort. Cliff.* 223. — Clayton, *Fl. Virgin.* 60.

L. foliis angulatis truncatis, Trew, *Pl. Ehret.* 2, t. 10.

LIRIODENDRON TULIPIFERA.

Yellow Poplar. Tulip Tree.

Linnæus, *Spec.* i. 535. — Du Roi, *Harbk. Baum.* i. 374. — Marshall, *Arbust. Am.* 78. — Wangenheim, *Nordam. Holz.* 32, t. 13, f. 32. — Walter, *Fl. Car.* 158. — Gærtner, *Fruct.* ii. 475, t. 178. — *Bot. Mag.* t. 275. — Abbot, *Insects of Georgia*, ii. t. 102. — Schkuhr, *Handb.* ii. 93, t. 147. — Willdenow, *Spec.* ii. 1254. — Michaux, *Fl. Bor.-Am.* i. 326. — *Nouveau Duhamel*, iii. 62, t. 18. — Desfontaines, *Hist. Arb.* ii. 15. — Poiret, *Lam. Dict.* viii. 137; *Ill.* iii. 36, t. 491. — Jaume St. Hilaire, *Pl. France*, iii. t. 377. — Michaux f. *Hist. Arb. Am.* iii. 202, t. 5. — Pursh, *Fl. Am. Sept.* ii. 382. — Nuttall, *Gen.* ii. 18. — Barton, *Med. Bot.* i. 91, t. 8. — De Candolle, *Syst.* i. 461; *Prodr.* i. 82. — Bigelow, *Med. Bot.* ii. 107, t. 31. — Hayne, *Dendr. Fl.* 115. — Elliott, *Sk.* ii. 40. — Torrey, *Fl. N. Y.* i. 28. — Rafinesque, *Med. Bot.* ii. 239. — Guimpel, Otto & Hayne, *Abbild. Holz.* 34, t. 29. — Audubon, *Birds*, t. 12. — Don, *Gen. Syst.* i. 86. — Spach, *Hist. Veg.* vii. 488. — Loudon, *Arb. Brit.* i. 284, t. — Torrey & Gray, *Fl. N. Am.* i. 44. — Dietrich, *Syn.* iii. 309. — Griffith, *Med. Bot.* 98, f. 58. — Emerson, *Trees Mass.* ed. 2, ii. 605, t. — Darlington, *Fl. Cestr.* ed. 3, 9. — Agardh, *Theor. et Syst. Pl.* t. 11, f. 2, 3. — Chapman, *Fl.* 14. — Curtis, *Geolog. Surv. N. Car.* 1860, iii. 77. — Lemaire, *Ill. Hort.* 15, t. 571. — Baillon, *Hist. Pl.* i. 143, f. 175–178. — Koch, *Dendr.* i. 380. — Eichler, *Verhandl. Bot. Ver. Brand.* xxii. 82, f. 1–3. — Sargent, *Forest Trees N. Am.* 10*th Census U. S.* ix. 22. — Lloyd, *Drugs and Med. N. Am.* ii. 3, t. 26, f. — Watson & Coulter, *Gray's Man.* ed. 6, 50.

Liriodendron procerum, Salisbury, *Prodr.* 379.

The Liriodendron is one of the largest and most beautiful trees of the American forest. The Occidental Plane and the Southern Cypress are the only American deciduous trees which grow to a larger size. It sometimes attains, under favorable conditions, a height of one hundred and sixty to one hundred and ninety feet, with a straight trunk eight or ten feet in diameter, destitute of branches for eighty or a hundred feet from the ground.[1] Individuals a hundred or a hundred and fifty feet tall, with trunks five or six feet in diameter, are still common. The branches, which are short and small in proportion to the size of the trunk, give to this tree a pyramidal habit, except in the case of old or very large individuals on which the head is spreading. The winter-buds are dark red, covered with a glaucous bloom. The smooth lustrous bark of the young branches is red or red-brown during their first and second seasons, turning dark gray during the third. The leaves, supported on slender angled petioles five or six inches long, are dark green and shining on the upper, and paler on the lower surface. They are five or six inches long by as many broad, and quiver with the slightest movement of the air.[2] The flowers, which are borne on stout peduncles an inch and a half to two inches long, appear in May. The fruit ripens late in September and in October.

Liriodendron Tulipifera is found from Rhode Island[3] to southwestern Vermont and west to the southern shores of Lake Michigan, and extends south to northern Florida, southern Alabama and Mississippi. It occurs west of the Mississippi River only in southeastern Missouri and the adjacent parts of Arkansas. It prefers deep rich and rather moist soil on the intervales of streams or on mountain slopes, and is most abundant and reaches its greatest development in the valleys of the rivers flowing into the Ohio, and on the lower slopes of the high mountains of North Carolina and Tennessee. The Tulip-tree, although widely distributed, is nowhere common enough to become the characteristic feature of the forest, and even in regions where the soil and climatic conditions are most favorable to it, more than four or five large specimens are seldom found growing on a single acre of ground.

[1] Ridgway, *Proc. U. S. Nat. Mus.* 1882, 59.

The great Tulip-tree on the steep slopes of Mount Mitchell in North Carolina, the highest point of land in North America east of the Rocky Mountains, has a trunk thirty-three feet round at three feet from the ground. It stands at the head of the cove between the pool in which Professor Elisha Mitchell lost his life June 27, 1857, and the hut of the well-known mountaineer, "Tom" Wilson, who discovered his body a few days later. This tree was visited by Mr. W. M. Canby in 1866, and was then in perfect health.

[2] It was perhaps this habit, recalling the Aspen and other species of Poplar, which led the early settlers in America to apply the name of "Poplar" to this tree.

[3] L. W. Russell, *Garden and Forest*, ii. 34.

John Tradescant,[1] who visited America about the middle of the seventeenth century, sent several plants from this country to England, and the Tulip-tree was perhaps among them.[2] It appeared in several English gardens soon after Tradescant's return from America, and was cultivated by Bishop Compton at Fulham as early as 1688,[3] a year later than the date of the publication of Hermann's description, which was drawn up from a tree in the Leyden garden.

Few permanent varieties of Liriodendron have been developed in cultivation, although for more than a hundred years it has been a favorite ornamental tree in America and Europe.[4] A form with nearly entire leaves, and others with the leaves marked with yellow or silver blotches, are known in gardens; and a seedling with strictly fastigiate branches appeared a few years ago in the nursery establishment of Simon-Louis at Metz in Germany, where it has been propagated.

Liriodendron Tulipifera is easily raised from seed,[5] the seed germinating during the second year after sowing, and it is easily transplanted. It grows rapidly; it is extremely hardy, and is one of the most beautiful and distinct American trees for ornamental or roadside planting.

[1] John Tradescant, a Dutch gardener who emigrated to England towards the end of the sixteenth century, obtained in 1629 the title of gardener to Charles the First. He had a garden and museum at Lambeth. His son, the second John Tradescant, traveled in Virginia to collect curiosities for this museum, and published in 1656, a few years after the death of his father, a catalogue of his plants.

[2] Evelyn, *Silva*, 79.

[3] Ray, *Hist. Pl.* ii. 1798.

[4] Miller, *Dict.* ed. 8.

[5] Cobbett, *Woodlands*, No. 523.

EXPLANATION OF THE PLATES.

Plate XIII. Liriodendron Tulipifera.

1. A flowering branch, natural size.
2. A winter-bud, natural size.

Plate XIV. Liriodendron Tulipifera.

1. A fruit, natural size.
2. Diagram of the flower.
3. A flower, a sepal and two petals removed.
4. A stamen, anterior view, enlarged.
5. A stamen, posterior view, enlarged.
6. A pistil, enlarged.
7. A stigma, enlarged.
8. Vertical section of an ovary, enlarged.
9. An ovule, much enlarged.
10. A carpel, enlarged.
11. Vertical section of a carpel, enlarged.
12. A seed, showing the raphe, enlarged.
13. A seed, showing the side opposite the raphe, enlarged.
14. Vertical section of a seed, enlarged.
15. Cross section of a seed, enlarged.
16. An embryo, much magnified.

C.E.Faxon del. Picart fr.sc.

LIRIODENDRON TULIPIFERA, L.

A.Riocreux direx.t Imp.R.Taneur, Paris.

C.E.Faxon del. Picart fr. sc.

LIRIODENDRON TULIPIFERA, L.

A. Riocreux direx.t Imp. R. Taneur, Paris.

ASIMINA.

FLOWERS axillary, solitary or in pairs; sepals valvate, 3; petals 6, in two series, unequal, imbricated in æstivation; stamens inserted on the subglobose receptacle, indefinite; pistils 3 to 15, distinct, many-ovuled. Fruit baccate; seeds horizontal, flattened, inclosed in a pulpy membranaceous aril; albumen ruminate.

Asimina, Adanson, *Fam. Pl.* ii. 365. — Meisner, *Gen.* 4. — Gray, *Gen. Ill.* i. 67; *Bot. Gazette*, xi. 161. — Bentham & Hooker, *Gen.* i. 24.

Anona, Linnæus, *Gen.* 158, in part. — A. L. de Jussieu, *Gen.* 283, in part.

Orchidocarpum, Michaux, *Fl. Bor.-Am.* i. 329.

Porcelia, Persoon, *Syn.* ii. 95, in part.

Uvaria, Endlicher, *Gen.* 832, in part. — Baillon, *Hist. Pl.* i. 281, in part.

Trees or shrubs, emitting a heavy disagreeable odor when bruised, with fleshy roots, minute cinereo-pubescent caducous bud-scales, and terete slender branches marked with conspicuous leaf-scars. Leaves conduplicate in vernation, destitute of stipules, alternate, entire, membranaceous or subcoriaceous, feather-veined, reticulate-venulose, deciduous. Flowers pedunculate, nodding, dingy green, purple or white, proterogynous, bad-smelling. Sepals ovate, smaller than the petals, green, deciduous. Petals hypogynous, sessile, ovate or obovate-oblong, reticulately veined, accrescent; the three exterior alternate with the sepals, spreading; those of the inner row opposite the sepals erect and much smaller than those of the outer row. Stamens linear-cuneate, densely packed on the receptacle; filaments shorter than the fleshy connective terminated by a broad truncate glandular tip; anthers extrorse, the cells oblong, separate, opening longitudinally. Pistils sessile on the summit of the receptacle, projecting from the globular mass of stamens; ovary one-celled; stigma sessile, unilateral at the tip; ovules four to twenty, horizontal, two-ranked[1] on the ventral suture, anatropous, the raphe towards the suture. Fruit sessile or stipitate, thick, oval or oblong, smooth, sometimes slightly torulose.[2] Seeds in one or two ranks; testa crustaceo-coriaceous, smooth; the tegmen adherent to the testa, its membranaceous appendages dividing the corneous albumen nearly to the axis. Embryo minute, next the hilum; cotyledons short.

The genus Asimina, as now known, is confined to eastern North America.[3] It contains the only species of the great Custard Apple family, widely distributed in both hemispheres, which extends far outside the tropics. Six species are distinguished: one, *Asimina triloba*, the most northern in its range, is a small tree; the others are low shrubs, confined to the south Atlantic and Gulf regions. The handsome white flowers of *A. grandiflora* are the largest of the genus. The fruit in all the shrubby species is small and barely edible.

The genus Asimina was separated by Adanson from Anona of Linnæus. Some later authors have united it with the allied old-world Uvaria, and the species have also been referred to the little known Peruvian genus Porcelia. Asimina is well characterized, however, by the heterogeneous petals of the

[1] The ovules in *Asimina parviflora* are indistinctly two-ranked, appearing nearly in a single series.

[2] Rarely more than three carpels mature from one flower, often only one or two.

[3] Three Cuban plants referred by Grisebach (*Cat. Pl. Cub.* 3) to Asimina are still imperfectly known. Their coriaceous nearly homogeneous petals separate them, however, from this genus. (A. Gray, *Bot. Gazette*, xi. 162.)

two rows. Those of the outer row are accrescent and spreading, and always larger than those of the inner, which are concave and erect; and in spite of their imbricated arrangement in æstivation, depended on to unite the species with Uvaria, the genus is generally maintained by botanists.

Asimina is formed from *Asiminier*, an early colonial name used by the French in America for *Asimina triloba*.[1]

[1] Asiminier from *Asimina*, the Algonquin corruption of the southern Illinois *rassimina*, used probably for the fruit ("*rassa*," a sleeve, and "*min*," pl. "*mina*," fruit, from its shape. *Century Dictionary*, 1889).

CONSPECTUS OF THE SPECIES.

Flowers from axils of deciduous leaves of the preceding year.
- Leaves membranaceous, mostly acute at both ends, obscurely venulose.
  - Flowers large, long-pediceled; seeds flattened . . . . . 1. A. TRILOBA.
  - Flowers small, nearly sessile; seeds turgid . . . . . 2. A. PARVIFLORA.
- Leaves retuse or obtuse, pubescent when young, subcoriaceous and conspicuously reticulate-venulose at maturity. Petals white.
  - Outer petals three or four times as long as those of the inner row . . . . 3. A. GRANDIFLORA.
  - Outer petals twice the length of those of the inner row . . . . . 4. A. CUNEATA.

Flowers from the axils of existing leaves.
- Leaves subcoriaceous, reticulate-venulose.
  - Leaves linear or narrowly spatulate; flowers large, usually erect; petals white, those of the outer row one and a half to two inches long . . . . . 5. A. ANGUSTIFOLIA.
  - Leaves cuneate-linear to oblong; flowers nodding, petals green turning purple, those of the outer row less than half an inch long, twice the length of those of the inner row . . . . . 6. A. PYGMÆA.

ASIMINA TRILOBA.

Papaw.

FLOWERS solitary; styles distinct, introrsely stigmatic; ovules numerous. Leaves ample, membranaceous.

Asimina triloba, Dunal, *Mon. Anon.* 83. — De Candolle, *Syst.* i. 479; *Prodr.* i. 87. — Elliott, *Sk.* ii. 42. — Guimpel, Otto & Hayne, *Abbild. Holz.* 66, t. 53. — Hayne, *Dendr. Fl.* 118. — Don, *Gen. Syst.* i. 91. — Loudon, *Arb. Brit.* i. 293, f. 39. — Gray, *Gen. Ill.* i. t. 26, 27. — Darlington, *Fl. Cestr.* ed. 3, 10. — Chapman, *Fl.* 15. — Curtis, *Geolog. Surv. N. Car.* 1860, iii. 94. — *Bot. Mag.* t. 5854. — Koch, *Dendr.* ii. 383. — Sargent, *Forest Trees N. Am. 10th Census U. S.* ix. 23. — Lloyd, *Drugs and Med. N. Am.* ii. 49, t. 33, f. 120–123. — Watson & Coulter, *Gray's Man.* ed. 6, 50.

Anona triloba, Linnæus, *Spec.* 537. — Du Roi, *Harbk. Baum.* i. 59. — Marshall, *Arbust. Am.* 10. — Lamarck, *Dict.* ii. 125. — Walter, *Fl. Car.* 158. — Willdenow, *Spec.* ii. 1267. — *Nouveau Duhamel*, ii. 83, t. 25. — Desfontaines, *Hist. Arb.* ii. 21. — Michaux f. *Hist. Arb. Am.* iii. 161, t. 9. — Schkuhr, *Handb.* ii. 95, t. 149.

Anona pendula, Salisbury, *Prodr.* 380.

Anona palustris, Abbot, *Insects of Georgia*, i. t. 4 (not Linnæus).

Orchidocarpum arietinum, Michaux, *Fl. Bor.-Am.* i. 329.

Porcelia triloba, Persoon, *Syn.* ii. 95. — Pursh, *Fl. Am. Sept.* ii. 383. — Rafinesque, *Fl. Ludovic.* 92. — Nuttall, *Gen.* ii. 19. — Poiret, *Lam. Dict.* Suppl. iv. 529. — Audubon, *Birds*, t. 2; ed. 8vo, iii. t. 147.

Uvaria triloba, Torrey & Gray, *Fl. N. Am.* i. 45. — Torrey, *Fl. N. Y.* i. 30. — Caruel, *Ann. Mus. Firenze*, 1864, 9, t. 1, f. 1–7. — Baillon, *Hist. Pl.* i. 193, f. 220–228; *Dict.* i. 290, f.

A. campaniflora, Spach, *Hist. Veg.* vii. 528.

A shrub or low tree, rising sometimes under favorable conditions to a height of thirty-five or forty feet,[1] with a straight trunk, rarely exceeding a foot in diameter, and slender spreading branches. The bark of the trunk, rarely more than an eighth of an inch thick on full-grown individuals, has a dark brown surface marked with large ash-colored blotches; it is covered with small wart-like excrescences, and divided by numerous shallow reticulate depressions. The inner bark is tough, fibrous, and separates easily into thin layers. The bark of the branchlets is light brown tinged with red, and plainly marked by longitudinal, parallel or reticulate, narrow shallow grooves. The winter-buds are acuminate, flattened on the side next the stem, an eighth of an inch long, and covered thickly with rusty brown hairs. The leaves, which are glabrous, light green on the upper and pale on the lower surface, are obovate-lanceolate, ten or twelve inches long, and four or five inches broad, sharply pointed, and gradually and regularly contracted at the base into a stout petiole half to three quarters of an inch long, and strengthened by a prominent midrib and primary veins. They are covered on the lower surface when they first appear, as are the petioles and young shoots, with a short rusty brown caducous tomentum, reduced on the upper surface of the young leaves to a few scattered hairs. The flowers, which are nearly two inches across when fully grown, appear at the extreme south in March, and open at the north in May and June. They are borne on stout club-shaped peduncles an inch or an inch and a half long, covered with long scattered rusty brown hairs. The sepals are ovate, acuminate, pale green, and densely pubescent on the outer surface. The petals are green when they first unfold, and are covered with short appressed hairs; they gradually turn brown, and at maturity are deep vinous red and conspicuously reticulate-venulose; those of the outer row are broadly ovate, rounded or pointed at the apex, reflexed at maturity above the middle, and are then two or three times longer than the sepals; those of the inner row are pointed, erect, the concave base glandular, nectariferous, and marked by a broad band of a lighter color.[2] The fruit, which is attached obliquely to the enlarged torus, is oblong, nearly cylindrical,

[1] Ridgway, *Proc. U. S. Nat. Mus.* 1882, 60.

[2] Baillon (*Adansonia*, vi. 253) suggests that the nectar secreted in considerable quantities from the glandular surface of the petals of Asimina serves to hold the pollen which falls from the anthers

rounded, or sometimes slightly pointed at the extremities, more or less falcate, and often irregular from the imperfect development of some of the seeds. It ripens in September and October. It is three to five inches long, an inch or an inch and a half in diameter, and weighs from six to twelve ounces. The seeds, which separate readily from the aril confluent with the pericarp, are an inch long, half an inch broad, ovate, and rounded at the extremities. The brown shining outer coat becomes paler on exposure to the air, and wrinkles by the shrinking of the albumen in drying.[1]

The western part of the state of New York and the northern shores of Lake Ontario[2] are the most northern points reached by *Asimina triloba;* it occurs in eastern and central Pennsylvania, and thence spreads west to southern Michigan, southern Indiana, and eastern Kansas, and south to middle Florida and to the valley of the Sabine River in Texas. It is comparatively rare in the region bordering the Atlantic seaboard; in the valley of the Mississippi River it is often very common, forming the thick forest-underwood on rich river-bottom lands, or sometimes exclusively occupying the ground with dense thickets many acres in extent. The presence of this tree is always an indication of deep rich and rather moist soil; it attains its greatest size in the fertile valleys of the streams flowing into the lower Ohio River, and in those of central and southern Arkansas.

The wood of *Asimina triloba* is light, soft and weak, coarse-grained and spongy, with the layers of annual growth clearly marked by several rows of large open ducts. The color of the heartwood is light yellow shaded with green, and rather darker than the thin sapwood composed of from twelve to twenty layers of annual growth. It has, when perfectly dry, a specific gravity of only 0.3969, a cubic foot of the dry wood weighing 24.74 pounds. The inner bark, stripped from the branches in the early spring, is still used by fishermen on the Ohio and other western rivers for stringing fish; formerly it was often employed in making fish-nets, and for similar purposes.[3]

The Papaw was first noticed in 1541[4] by the followers of De Soto in the valley of the Mississippi. It was not described, however, until more than two centuries later, when Catesby published a figure of it in his *Natural History of Carolina.*[5] The Papaw was first cultivated in Europe in 1736 by Peter Collinson, who probably received it from John Bartram. Although rarely seen in cultivation outside of botanical gardens, it is well worth a place in ornamental plantations for its large and conspicuous foliage and for its handsome flowers and fruit. The Papaw[6] is only precariously hardy in New England.

into the cup of the corolla. It seems more probable, however, that its object is to attract insects, without whose aid the proterogynous flowers would be obliged to depend for fertilization on the dubious chance of the pollen of one flower dropping or being blown upon the stigma of another.

[1] The skin of the fully grown fruit is at first green covered with a glaucous bloom. The flesh at this time is green, gradually turning white towards the centre; it is firm and may be broken with a sharply defined fracture which generally intersects a seed from which it separates easily, and has a fetid odor and a most disagreeable flavor. As the fruit ripens the flesh changes from green to yellow, the tough grain becoming soft. When fully ripe the skin is dark brown or almost black; the flesh is then semi-transparent, sweet and luscious to the taste, the delicacy of the flavor increasing after the fruit has been slightly frozen. The fruit of the Papaw in this stage is wholesome and can be eaten freely. It is sold in large quantities in cities and towns in those parts of the country where the tree grows naturally, although it is not sent to the large eastern markets.

"Papaw eaters recognize two varieties of the fruit, the white and the yellow. The yellow papaw flesh is edible, but there is no difference in the trees. White papaws retain their disagreeable odor until they decay; they do not turn yellow upon ripening, and will sicken those who highly relish the other fruit." (Lloyd, *Drugs and Med. N. Am.* ii. 51.)

[2] J. W. Burgess, *Bot. Gazette*, vii. 95.

[3] A white colorless and tasteless alkaloid, Asimine, has been obtained by Lloyd from the seeds of *Asimina triloba.* (Lloyd, *l. c.* ii. 54.) Preliminary studies of this new product show that it acts on the brain of animals, causing somnolence and finally stupor and unconsciousness.

[4] "There is a fruit through all the countrie which groweth on a plant like ligoacan, which the Indians doe plant. The fruit is like unto peares riall: it hath a verie good smell, and an excellent taste." (*The Discovery and Conquest of Terra Florida*, Hakluyt, Rye's ed. 169.)

[5] *Anona fructu lutescente, lævi, scrotum Arietis referente*, ii. 85, t. 85. — Trew, *Pl. Ehret.* i. t. 5. — Duhamel, *Traité des Arbres*, i. 56, t. 19. — Clayton's description in the *Flora Virginica*, 61, published in 1739, refers to the Papaw, which was confounded, however, by Gronovius with a West Indian species of Anona.

Anona foliis lanceolatis, fructibus trifidis, Miller, *Dict. Icon.* i. 23, t. 35.

[6] The popular name Papaw was probably given to *Asimina triloba* from a fancied resemblance of the fruit to the true papaw, the fruit of *Carica Papaya*, L., of tropical America.

EXPLANATION OF THE PLATES.

Plate XV. Asimina triloba.

1. A flowering branch, natural size.
2. Diagram of a flower.
3. Vertical section of a flower, natural size.
4. A flower, the sepals and petals removed, enlarged.
5. An anther, anterior view, enlarged.
6. An anther, posterior view, enlarged.
7. A gynœcium, enlarged.
8. Vertical section of a pistil, enlarged.
9. Cross section of an ovary, enlarged.
10. An ovule, much enlarged.
11. A leaf, natural size.

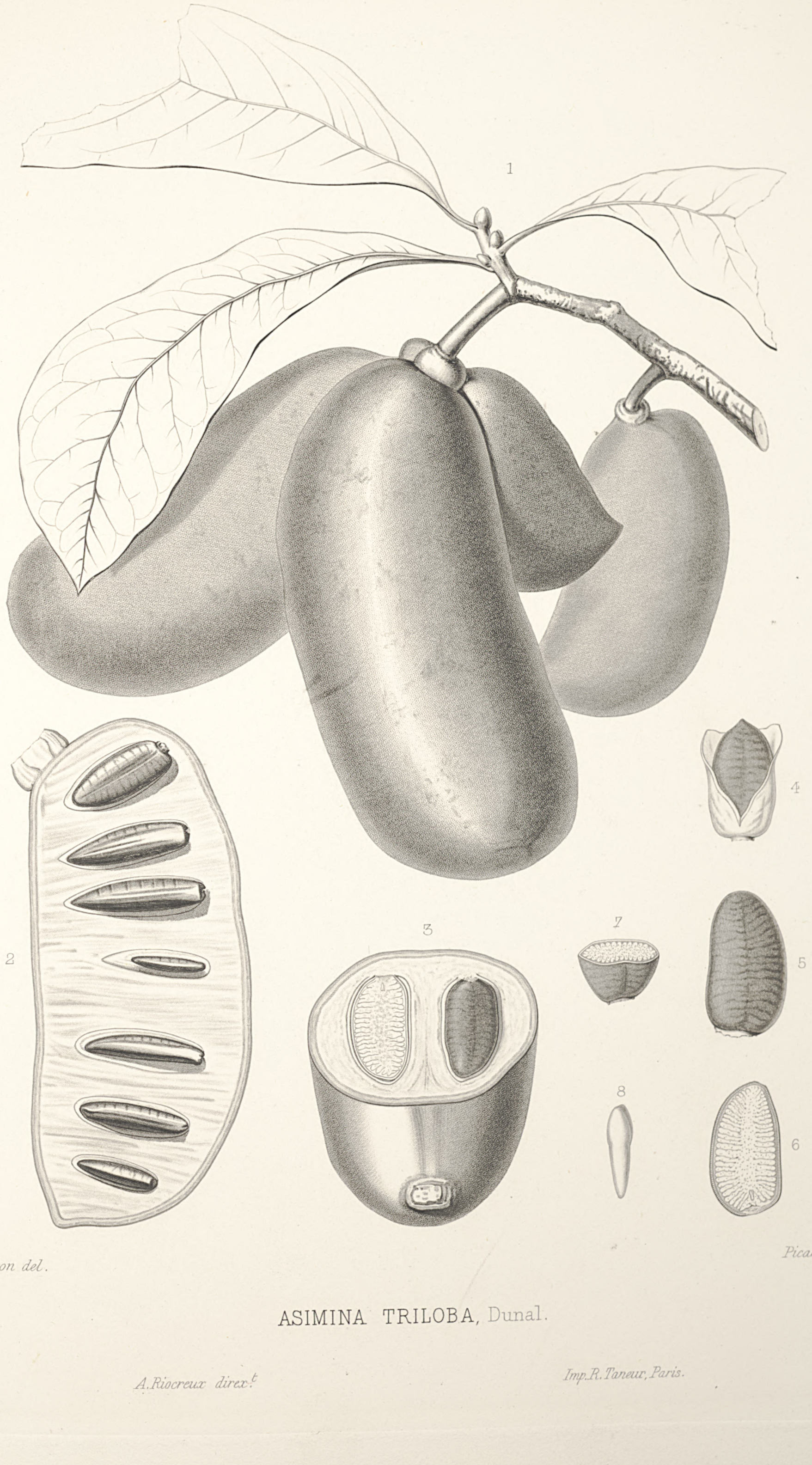
Plate XVI. Asimina triloba.

1. A fruiting branch, natural size.
2. Vertical section of a fruit, natural size.
3. Cross section of a fruit, natural size.
4. A seed, with its aril laid open, natural size.
5. A seed, natural size.
6. Vertical section of a seed, natural size.
7. Cross section of a seed, natural size.
8. An embryo, much enlarged.

C.E.Faxon del. Picart fr. sc.

ASIMINA TRILOBA, DUNAL.

A.Riocreux direx.t Imp.R.Taneur, Paris.



C.E.Faxon del. Picart fr. sc.

ASIMINA TRILOBA, Dunal.

A.Riocreux direx.t Imp.R.Taneux, Paris.

ANONA.

FLOWERS solitary, fascicled, or rarely cymosely racemose, terminal or extra axillary; sepals 3, valvate; petals usually 6, in two series, valvate or rarely imbricated in æstivation; stamens inserted on a hemispherical receptacle, indefinite. Carpels confluent into a many-celled fleshy fruit; seeds inclosed in an aril; albumen ruminate.

Anona, Linnæus, *Gen.* 158, in part. — Adanson, *Fam. Pl.* ii. 365. — A. L. de Jussieu, *Gen.* 283. — Meisner, *Gen.* 4. — Endlicher, *Gen.* 834. — Bentham & Hooker, *Gen.* i. 27. — Baillon, *Hist. Pl.* i. 285.

Trees or shrubs, emitting a pungent aromatic odor when bruised, with fleshy roots, glandular and often reticulated bark, and terete slender branches marked with conspicuous leaf-scars, and often pubescent during the first season. Leaves conduplicate in vernation, destitute of stipules, alternate, entire, coriaceous, feather-veined, often glandular-punctate, persistent or tardily deciduous. Flowers nodding on bracted peduncles. Calyx small, three-lobed, or composed of three concave subcordate acute sepals, green, deciduous. Petals hypogynous, sessile, ovate, acuminate or obtuse, concave, triquetrous at the apex, thick and fleshy, generally white or yellow, the exterior alternate with the sepals; those of the inner row opposite the sepals often much smaller than those of the outer row, and sometimes reduced to minute scales or absent. Stamens club-shaped, densely packed on the receptacle; filaments shorter than the fleshy connective terminated by a broad ovoid truncate often glandular tip extending above the extrorse anthers; their cells oblong, contiguous, opening longitudinally. Pistils sessile on the receptacle, free or united; ovary one-celled; stigmas sessile or slightly stipitate, oblong; ovules one, or rarely two,[1] erect, anatropous; raphe ventral. Fruit ovate or globose, the surface muricate, squamulose or smooth, many-seeded. Seeds ovate or elliptical; testa crustaceo-coriaceous, smooth, chestnut-brown; the tegmen adherent to the testa, its broad appendages penetrating the albumen nearly to the axis. Embryo minute, the radicle next the hilum; cotyledons appressed.

The genus Anona is found in tropical America and in tropical Africa. About fifty species have been described by botanists. A single species extends north of the tropics to the coast of southern Florida and to the Bahama Islands. Six African species are known;[2] twenty-eight species, including two or three naturalized from the West Indies, are found in Brazil;[3] ten or twelve species are Central American,[4] one at least extending south of the equator to Peru;[5] the remainder inhabit the West Indies[6] and the northern countries of the South American continent.[7]

Several species cultivated for their fruit have become naturalized in the tropics of the two worlds.[8] The Sweetsop or Sugar Apple (*A. squamosa*)[9] is now perhaps the most widely distributed and the most firmly fixed in the Old World.[10] The yellow-green fruit, two to four inches across, is oblong and embossed with oblong, obtuse scales; the flesh is soft and white, with an agreeable perfume and insipid flavor. The seeds are acrid and are used as an insecticide. The soursop, the ovoid or nearly globular

[1] Baillon, *Hist. Pl.* i. 229.

[2] Baker, *Fl. Maur. and Seych.* 3. — Oliver, *Fl. Trop. Afr.* 14.

[3] St. Hilaire, *Fl. Bras. Merid.* i. 24. — Martius, *Fl. Brasil.* xiii. 1, 3.

[4] Hemsley, *Bot. Biol. Am. Cent.* i. 18.

[5] *A. Cherimolia* Miller, *Dict.* (A. De Candolle, *Origine des Plantes Cultivées*, 138.)

[6] Sloane, *Nat. Hist. Jam.* ii. 166. — Browne, *Nat. Hist. Jam.* 255. — Maycock, *Fl. Barb.* 232. — Macfadyen, *Fl. Jam.* 6. — Richard, *Fl. Cub.* 27. — Grisebach, *Fl. Brit. W. Ind.* 4.

[7] Aublet, *Fl. Guian.* i. 611.

[8] A. De Candolle, *Géographie Botanique*, ii. 859; *Origine des Plantes Cultivées*, 133.

[9] Linnæus, *Spec.* 537. — Descourtilz, *Fl. Med. Antil.* ii. 65, t. 83. — *Bot. Mag.* t. 3095. — Tussac, *Fl. Antil.* iii. 4. — Van Nooten, *Fleurs Jav.* t. 19.

[10] Hooker f. *Fl. Brit. Ind.* i. 78. — Brandis, *Forest Fl. Ind.* 6. The fruit of *A. squamosa* is called "custard apple" in India, the American name of the fruit of *A. reticulata*.

fruit of *A. muricata*, is three or four inches across, covered with short incurved points.[1] The green or yellow surface has a terebinthine odor and a disagreeable flavor; it is easily removed from the white subacid aromatic flesh, which is eaten with or without sugar, or is cooked as a vegetable when partly grown. The fruit is considered an antiscorbutic and febrifuge, and a powder prepared from the dried unripe fruit is used in the treatment of dysentery. *Anona reticulata*[2] is now generally naturalized and widely cultivated in the tropics,[3] but its fruit, the custard apple or bullock's heart, which is subglobose with a rough skin marked with pentagonal areoles, is less esteemed than the fruit of the other cultivated species. The cherimoyer, the fruit of *A. Cherimolia*, a native probably of western tropical America from Mexico to below the equator, and now cultivated and naturalized throughout the tropics, is the best fruit produced by any species of the genus. Many travelers have declared the flavor of the cherimoia, recalling the strawberry and banana, more delicate and exquisite than that of any other fruit. The pulp of the fruit of all these species is refreshing, aromatic, and agreeable; but, as is the case with many tropical fruits, it is really inferior to the best products of the temperate zone. The fruit of Anona eaten with sugar before it is fully ripe is a useful tonic, and the fermented juice is manufactured into a sort of sweet wine or cider in the West Indies.

The genus was first established by Plumier as Guanabanus;[4] this name was discarded by Linnæus for Anona,[5] the name given by early authors[6] to the Soursop. Linnæus changed Anona to Annona (the year's product) in the *Hortus Cliffortianus* in order to avoid the use of names of barbarous origin.

[1] Linnæus, *Spec.* 537. — Descourtilz, *Fl. Med. Antil.* ii. t. 87. — Tussac, *Fl. Antil.* ii. t. 24. — Van Nooten, *Fleurs Jav.* t. 39.

[2] Linnæus, *Spec.* 537. — Descourtilz, *Fl. Med. Antil.* ii. t. 82. — *Bot. Mag.* t. 2912. — Van Nooten, *Fleurs Jav.* t. 20.

[3] Hooker f. *Fl. Brit. Ind.* i. 78.

[4] *Nov. Plant. Am. Gen.* 42, t. 10. Guanabanus, from the Indian *Guanabano*, was adopted by Oviedo to designate *A. muricata*. (*Hist. Gen. Nat. Ind.* lib. 8, cap. 17.)

[5] From *Hanon*, used by Oviedo (*l. c.*) to designate *A. squamosa*, lib. 8, cap. 18, t. 3, f. 7.

[6] Commelyn, *Hort.* i. 133, t. 69. — Hermann, *Cat. Hort. Lugd. Bat.* 645. — Plukenet, *Alm. Bot.* 31, t. 134, f. 2.

ANONA GLABRA.

Pond Apple.

GLABROUS throughout, peduncles solitary, opposite the leaves. Petals 6. Fruit smooth, faintly marked with pentagonal areoles.

A. glabra, Linnæus, *Spec.* 537. — Marshall, *Arbust. Am.* 10. — Lamarck, *Dict.* ii. 125, exc. syn. — Du Roi, *Harbk. Baum.* i. 62. — Willdenow, *Spec.* ii. 1267. — Dunal, *Mon. Anon.* 74. — De Candolle, *Syst.* i. 475; *Prodr.* i. 85. — Dietrich, *Syn.* iii. 306. — Chapman, *Bot. Gazette*, iii. 2. — Sargent, *Garden and Forest*, ii. 616.

A. laurifolia, Dunal, *Mon. Anon.* 65. — De Candolle, *Syst.* i. 468; *Prodr.* i. 84. — Dietrich, *Syn.* iii. 304. — Grisebach, *Fl. Brit. W. Ind.* 4. — Chapman, *Fl.* ed. 2, Suppl. 603. — Cooper, *Smithsonian Rep.* 1860, 439. — Sargent, *Forest Trees N. Am.* 10*th Census U. S.* ix. 23.

Porcelia parviflora, Audubon, *Birds*, t. 162 (not Persoon).

A low tree, thirty to forty feet high, with a short trunk often eighteen inches in diameter above the swell of the thickened tapering base, which is sometimes strengthened by spreading buttresses, and with stout wide-spreading often contorted branches. The bark of the trunk is an eighth of an inch thick, dark red-brown, divided by broad shallow anastomosing fissures, the surface separating into numerous small scales. The bark of the branches is brown or yellow during their first season, turning brown during the second, when the surface is broken by numerous depressions, and marked by small scattered wart-like excrescences. The persistent leaves are bright green on the upper, and paler on the lower surface, coriaceous, oval or oblong, acute, tapering or rounded at the base, with a prominent midrib and stout petiole half an inch long. They are three to five inches long and one and a half to two inches broad, and in Florida appear in March and April. The nodding flowers, borne on short stout peduncles thickened at the two extremities and bearing at their base a pair of minute acute membranaceous deciduous bracts, open in April from an ovoid three-angled bud. The calyx is three-lobed, with broadly ovate acute divisions. The petals are valvate in æstivation, connivent, acute, concave, pale yellow or dirty white; those of the outer row are marked on the inner surface near the base with a bright red spot; those of the inner row are narrower and somewhat shorter. The fruit ripens in November. It is broadly ovate, truncate or depressed at the base, rounded at the other end, three to five inches long and two to three and a half inches broad. The color of the thick leathery skin is light green when the fruit is fully grown, turning yellow as it becomes fully ripe, when it is often marked by numerous dark brown blotches. The flesh surrounding the thick elongated fibrous torus is light green, slightly aromatic, insipid, edible but of no comestible value. The seeds, inclosed in a thin aril, are half an inch long, slightly obovate, turgid, rounded at the extremities, the margins contracted into a narrow wing formed by the thickening of the outer coat.

Anona glabra is found in Florida from Cape Malabar on the east coast to the shores of Bay Biscayne, and on the west coast from Pease Creek to the Caloosa River.[1] It occurs on the Bahama Islands, on San Domingo, and on St. Thomas and St. Croix.[2]

Anona glabra grows in Florida in shallow fresh-water ponds, on swampy hummocks, or by the borders of small fresh-water streams flowing from the Everglades. It reaches its largest size on the shores of Bay Biscayne near the Miami River, where it is found surrounded and overshadowed by

[1] A number of trees of *Anona glabra* are growing in a small pond within the present limits of the city of Key West. This tree is not found, however, elsewhere on the island, or on any of the neighboring keys; and as it was not noticed by Dr. Blodgett, who explored the Key West flora fifty years ago, it was perhaps introduced here from the mainland, or more probably from the Bahamas, as there was early and constant communication between New Providence and Key West.

[2] I have not seen West Indian specimens; and these stations are given on the authority of Dunal (*l. c.*) and of Eggers. (*Fl. St. Croix and the Virgin Islands, Bull. U. S. Nat. Mus.* No. 13, 23.)

the Live Oak, the Mastic, the Pigeon Plum, the Lancewood, the Red Mulberry, the Gumbo Limbo, and the Black Calabash.

The wood of *Anona glabra* is light, soft, and not strong, and contains numerous large open scattered ducts; it is light brown streaked with yellow, and has, when perfectly dry, a specific gravity of 0.5053, a cubic foot of the dry wood weighing 31.49 pounds.[1]

Anona glabra was first made known by Catesby.[2] He gave no locality for the plant, which he probably obtained from the Bahama Islands, where it was seen by Michaux in 1789.[3] The excellent figure of *Anona glabra* in the *Birds of America* shows that Audubon, who visited south Florida in 1835, was the first naturalist to detect this tree in North America. His discovery was overlooked, however, by botanists, and *Anona glabra* was not recognized as a Florida plant until 1859, when it was found by Dr. J. G. Cooper[4] on the shores of Bay Biscayne.

[1] No difference can be detected between the heartwood and sapwood in the specimens examined, although it is possible that the trees from which they were taken were not old enough to form heartwood.

[2] *Anona maxima, foliis latis fructu maximo luteo conoide, cortice glabro, Nat. Hist. Car.* ii. 64, t. 64.

Anona fructu viridi lævi, Pyri inversi forma, Nat. Hist. Car. ii. 67, t. 67.

[3] *Jour.* in *Proc. Am. Phil. Soc.* xxvi. 51. There are two entries in Michaux's *Journal* which indicate that he may have found *Anona glabra* on the east coast of Florida. No specimens, however, are preserved in his herbarium, and his remarks may refer to one of the large-flowered dwarf Asiminas. (*Journal*, 32, 33.)

[4] J. G. Cooper, born in New York June 19, 1830, graduated from the College of Physicians and Surgeons in New York in 1853. He received soon after graduation the appointment of naturalist and surgeon to the expedition organized under the leadership of General Isaac I. Stevens, to explore a northern route for a railroad to the Pacific Ocean. The scientific fruits of this journey were published in volume xii. part 2 of the Pacific Railroad Reports. Dr. Cooper devoted much attention for several years to studying the geographical distribution of North American trees, the results of these investigations being published in the reports of the Smithsonian Institution for 1858 and 1860. He visited south Florida in 1859, and made several interesting botanical discoveries there. Dr. Cooper, as surgeon of a government exploring expedition, had an opportunity in 1860 of seeing the country between Fort Benton on the Missouri River and the waters of the Columbia. The results of his observations upon the trees of this region were published in the third volume of the *American Naturalist*, in an article entitled *The Trees of Montana*. He joined during the same year the Natural History Survey of California as a member of the zoölogical staff, and is still a resident of that state.

EXPLANATION OF THE PLATES.

PLATE XVII. ANONA GLABRA.

1. A flowering branch, natural size.
2. Diagram of a flower.
3. Vertical section of a flower, natural size.
4. A flower, the sepals and petals removed, natural size.
5. A flower, the petals and stamens removed, natural size.
6. A stamen, anterior view, enlarged.
7. A stamen, posterior view, enlarged.
8. Vertical section of an ovary, enlarged.
9. Cross section of an ovary, enlarged.
10. An ovule, much enlarged.

PLATE XVIII. ANONA GLABRA.

1. A fruit, natural size.
2. Section of a fruit, natural size.
3. A seed, with its aril laid open, natural size.
4. A seed, natural size.
5. Vertical section of a seed, natural size.
6. Cross section of a seed, natural size.
7. An embryo, much enlarged.

C.E. Faxon del.

Picart fr. sc.

ANONA GLABRA, L.

A. Riocreux direx.t

Imp. R. Taneur, Paris.

C.E.Faxon del. Picart fr. sc.

ANONA GLABRA, L.

A.Riocreux direx.t Imp. R.Taneur. Paris.

CAPPARIS.

FLOWERS perfect; sepals 4, rarely 5; petals usually 4, imbricated; torus short, destitute of basal appendages. Fruit baccate, stalked; embryo convolute.

Linnæus, *Gen.* 155. — Adanson, *Fam. Pl.* ii. 407. — A. L. de Jussieu, *Gen.* 243. — Meisner, *Gen.* 17. — Endlicher, *Gen.* 893. — Bentham & Hooker, *Gen.* i. 108. — Baillon, *Hist. Pl.* iii. 174.

Trees or shrubs, with watery acrid or often pungent juice, sometimes climbing or prostrate, unarmed or armed with short, often recurved, stipular spines, glabrous, pubescent or variously lepidote. Leaves conduplicate in vernation, alternate, rarely opposite or more rarely wanting, entire, feather-veined, membranaceous or coriaceous; stipules spinescent or setaceous, often confined to young or barren shoots. Flowers regular or irregular, axillary or supra-axillary, solitary, fascicled or arranged in a terminal cyme or raceme, usually bracteate. Sepals valvate or imbricate, in two series, free, or the two outer united in the bud, and splitting irregularly as the flower opens, naked or glandular on the inner surface. Petals rarely more than four, inserted on the base of the receptacle. Stamens usually indefinite, inserted on the receptacle; filaments filiform, free, much longer than the short two-celled introrse anthers. Ovary long-stalked, one to four-celled, with two or more parietal placentas; stigma sessile, orbiculate, rarely slightly two-lobed; ovules indefinite, campylotropous. Fruit globose, elongated or siliquiform, indehiscent or rarely separating into three or four valves; seeds reniform, numerous or indefinite, immersed in pulp, exalbuminous; testa corneous or crustaceous. Embryo convolute; cotyledons foliaceous, fleshy.[1]

The genus Capparis is widely and generally distributed over the warmer parts of the earth. More than a hundred species, chiefly tropical, are distinguished. Its greatest development in number of species is in Central and South America;[2] one species, *Capparis spinosa*,[3] abounds in southern Europe, extending through the Orient to India, where about thirty species are known;[4] two others occur in the Orient,[5] eight are found in south Africa,[6] thirteen are tropical African,[7] twelve are Australian,[8] and one is Hawaiian.[9] Five species are known in China[10] and eighteen in Central America and Mexico,[11] while two of the nine or ten West Indian[12] species reach the shores of southern Florida, the most northern station of the genus in America.[13]

The useful properties of Capparis are not numerous. The flower-buds and sometimes the young fruit of *C. spinosa* pickled in vinegar furnish the well-known capers of commerce.[14] The bark of the

[1] The genus Capparis may be divided, chiefly upon characters found in the remarkable differences in the calyx, into nine sections which have been sometimes considered generically distinct. Each is composed of species confined either to the Old or to the New World. (De Candolle, *Prodr.* i. 245. — Bentham & Hooker, *Gen.* i. 109.)

[2] Eichler, *Martius Fl. Brasil.* xiii. 1, 267.

[3] Linnæus, *Spec.* 503. — Sibthorp, *Fl. Græc.* t. 486. — Delessert, *Icon. Sel.* iii. t. 10. — Baillon, *Hist. Pl.* iii. 150, f. 174–179; *Dict.* i. 618.

[4] Hooker f. *Fl. Brit. Ind.* i. 173.

[5] Boissier, *Fl. Orient.* i. 419.

[6] Harvey & Sonder, *Fl. Cap.* i. 61.

[7] Oliver, *Fl. Trop. Af.* i. 94.

[8] Bentham, *Fl. Austral.* i. 93.

[9] Hillebrand, *Fl. Haw. Is.* 14.

[10] Forbes & Hemsley, *Jour. Linn. Soc.* xxiii. 50.

[11] Hemsley, *Bot. Biol. Am. Cent.* i. 43.

[12] Grisebach, *Fl. Brit. W. Ind.* 17.

[13] *Capparis cynophallophora* (Linnæus, *Spec.* 504. — Jacquin, *Stirp. Am.* 158, t. 98. — Descourtilz, *Fl. Med. Antil.* v. 193, t. 355. — Eichler, *Martius Fl. Brasil.* xiii. 1, 282, t. 63, 2) a shrubby species with oblong, blunt or emarginate, coriaceous leaves and linear fruit, widely distributed through tropical America, is the second species found in Florida.

[14] *Capparis spinosa* is a trailing undershrub, with large white showy axillary pedunculate flowers, growing naturally in the crevices of rocks and walls. Its cultivation gives employment to a

root of this species has a sharp bitter taste, and was formerly used as a tonic. The flower-buds of *C. aphylla* are used as a pickle in India; the unripe fruit is cooked and eaten, and a bitter condiment is prepared from both the ripe and the unripe fruit.[1] The bark of the roots of several American species contains, according to Baillon,[2] exciting and epispastic properties. The fruit of *C. Breynia* and probably of *C. Jamaicensis* is believed in the West Indies to be antispasmodic, and its flowers and roots anthysteric and aperative. The fruit of *C. frondosa* and of *C. pulcherrima* is considered poisonous in the West Indies; and horses and mules are killed, according to Martius,[3] by eating the leaves of *C. Yco*, a Brazilian species. The leaves of *C. Dahi* and *C. Mithridatica* are used in Africa in the treatment of snake bites.[4]

The wood of two or three Indian species is hard and durable, and is used by the natives in the construction of small houses, for agricultural implements, and in boat-building.[5] *C. sepiaria* is employed in India as a hedge-plant, for which purpose its stout branches with sharp hooked stipular spines adapt it.[6]

Capparis, the classical name of *C. spinosa*, is from the Greek *κάππαρις*, the name given to this plant by Dioscorides, and derived from the Persian *kabar*, capers.

large number of persons in southern France and Italy, and permits the profitable use of dry and sterile land unsuitable for other crops. Pomet, *Hist. Gen. Drog.* 245. — *Nouv. Cours d'Agr.* iii. 414.

[1] Brandis, *Forest Fl. Ind.* 14.

[2] *Hist. Pl.* iii. 169.

[3] *Syst. Mat. Med. Brasil.* 74.

[4] Baillon, *Hist. Pl.* iii. 169.

[5] Gamble, *Man. Ind. Timbers*, 15.

[6] Cleghorn, *Forests and Gardens, S. Ind.* 211.

CAPPARIS JAMAICENSIS.

FLOWERS in a terminal cyme; sepals valvate, glandular. Fruit siliquiform, valvular-dehiscent.

Capparis Jamaicensis, Jacquin, *Enum. Pl. Carib.* 23; *Stirp. Am.* 160, t. 101. — *Icon. Am. Gewäch.* ii. 38, t. 171. — Aiton, *Hort. Kew.* ed. 2, iii. 285. — De Candolle, *Prodr.* i. 252. — Macfadyen, *Fl. Jam.* 39. — Dietrich, *Syn.* iii. 231. — Chapman, *Fl.* 32. — Eichler, *Martius Fl. Brasil.* xiii. 1, 270, t. 64, f. 2.

C. emarginata, Richard, *Fl. Cub.* 78, t. 9. — Walpers, *Rep.* i. 201.

C. Jamaicensis, var. emarginata, Grisebach, *Fl. Brit. W. Ind.* 18.

A small slender shrubby tree, growing in Florida to a height of eighteen or twenty feet, with a straight trunk sometimes five or six inches in diameter. The bark of the trunk is rarely more than an eighth of an inch thick, slightly fissured, the dark red-brown surface broken into small irregularly-shaped divisions; that of the branches is dark gray, smooth or slightly rugose. The branchlets are angled and covered like the under surface of the leaves, the petioles and inflorescence, with minute ferruginous scales, which are most abundant and darkest colored on the flower-buds and their stout angled stems. The leaves are oblong-lanceolate, rounded and emarginate at the apex, slightly revolute, coriaceous, with a prominent midrib and inconspicuous primary veins; they are two to three inches long and an inch or an inch and a half broad, the upper surface rather light yellow-green, smooth and lustrous. The flower-buds are obtuse or acute, four-angled by the prominently reduplicate margins of the sepals. The showy fragrant flowers open in Florida, in April and May. The sepals are ovate, acute, lepidote on the outer surface, and furnished on the inner with a small ovate gland; they are recurved when the flower is fully expanded, and are about half the size of the rounded membranaceous white petals which turn purple in fading. The filaments of the twenty to thirty stamens are purple and conspicuously villose towards the base, and are an inch and a half to nearly two inches long; the anthers are yellow. The slender stalk of the ovary is an inch and a half or more in length and quite glabrous. The fruit is nine to twelve inches long, terete, sometimes slightly torulose, pubescent-lepidote, the long stalk appearing jointed by the enlargement of the pedicel and torus below the insertion of the stipe. The outer coat of the seeds is light brown and coriaceous.[1]

Capparis Jamaicensis grows on the Florida coast from Cape Canaveral to the southern keys, on which, although nowhere common, it is generally distributed. It grows with the small Eugenias, the Exostema, the Rhamnidium, the Condalia, and the Pisonias, which form a large part of the shrubby second growth which has replaced the original forests on Key West and some of the neighboring islands. The largest trees noticed in Florida are on Upper Metacombe and Umbrella Keys, two small islands east of Key West. It was first distinguished in Jamaica, and occurs in Cuba, Dominica, the Bahamas, and probably on some of the other West Indian Islands.

The wood of *Capparis Jamaicensis* is yellow faintly tinged with red. It is heavy, hard, close-grained, and satiny, and contains many evenly distributed large open ducts and obscure medullary rays. The specific gravity of the absolutely dry wood is 0.6971, a cubic foot of the dry wood weighing 43.44 pounds. The sapwood, composed of about fifteen layers of annual growth, is rather lighter colored.

Capparis Jamaicensis was discovered in Florida by Dr. John L. Blodgett.[2]

[1] *Capparis Jamaicensis* belongs to the section *Quadrella* (Bentham & Hooker, *Gen.* i. 109. — Eichler, *Martius Fl. Brasil.* xiii. 1, 267). The species are all American, and are distinguished by large valvate glandular sepals and siliquiform dehiscent fruit; they are unarmed, destitute of sepals, and lepidote.

[2] John Loomis Blodgett (1809–1853), a native of South Amherst,

Massachusetts; received a medical diploma at Pittsfield; moved to Ohio in 1834, and then, in search of a milder climate, to Mobile, Alabama; was appointed physician and surgeon of the Mississippi and Louisiana Colonization Society engaged in the removal of liberated slaves to Liberia, where he remained during two years. Returning to America, Dr. Blodgett settled, in December, 1838, in Key West, where he established himself as a physician and druggist, and where he continued to reside until nearly the time of his death, which occurred in Amherst. Dr. Blodgett is the first botanist who explored the flora of the south Florida keys; his collections were communicated to Torrey and to Nuttall who published several of the trees in his continuation of Michaux's *Sylva* in 1842. His collections of seaweeds, in which he became specially interested in the last years of his life, were sent to Dr. W. H. Harvey of Dublin, author of the *Nereis Boreali-Americana.*

EXPLANATION OF THE PLATE.

Plate XIX. Capparis Jamaicensis.

1. A flowering branch, natural size.
2. A fruiting branch, natural size.
3. Diagram of a flower.
4. A flower, the petals and all but one stamen removed, showing the glands at the base of the sepals, natural size.
5. An anther, posterior view, enlarged.
6. An anther, anterior view, enlarged.
7. Vertical section of an ovary, enlarged.
8. An ovule, much enlarged.
9. Vertical section of a portion of a fruit, enlarged.
10. Vertical section of a seed, enlarged.
11. An embryo, much enlarged.
12. An epidermal scale, much enlarged.

C.E. Faxon del.

Picart fr. sc.

CAPPARIS JAMAICENSIS, Jacq.

A. Riocreux direx.t

Imp. R. Taneur, Paris.

CANELLA.

FLOWERS perfect, regular; sepals 3, imbricated, persistent; petals 5, imbricated; stamens monadelphous. Fruit baccate, indehiscent, 2 to 4-seeded.

Canella, Browne, *Nat. Hist. Jam.* 275, t. 27, f. 2, 3. — Meisner, *Gen.* 42. — Endlicher, *Gen.* 1029. — Bentham & Hooker, *Gen.* i. 121. — Baillon, *Hist. Pl.* i. 191.

Winterania, Linnæus, *Syst.* ed. 10, 1045, Appx. 1366; *Gen.* ed. 6, 238. — A. L. de Jussieu, *Gen.* 263.

A tree, with scaly aromatic bark, stout ashy gray branchlets conspicuously marked with large orbicular leaf-scars. Leaves petiolate, alternate, destitute of stipules, penniveined, entire, pellucid-punctate, coriaceous. Flowers arranged in a many-flowered subcorymbose terminal or subterminal panicle composed of several dichotomously branched cymes from the axis of the upper leaves or of minute caducous bracts. Sepals suborbiculate, concave, coriaceous, erect, their margins ciliate. Petals hypogynous, in a single row on the slightly convex receptacle, oblong, concave, rounded at the extremity, fleshy, twice the length of the sepals, white or rose-colored. Stamens about twenty, hypogynous, the filaments connate into a tube crenulate at the summit, and slightly extended above the linear anthers, which are adnate to its outer face, and longitudinally two-valved. Ovary free, included in the androecium, cylindrical or oblong-conical, one-celled, with two parietal placentas, few-ovuled; style short, fleshy, the summit two or three-lobed, stigmatic; ovules arcuate, horizontal or descending, imperfectly anatropous, attached by a short funiculus. Fruit globular or slightly ovate, fleshy, minutely pointed with the base of the persistent style. Seeds reniform, suspended; testa thick, crustaceous, shining black; tegmen soft, membranaceous. Embryo curved, near the summit of the copious oleo-fleshy albumen, its radicle next the hilum; cotyledons oblong.

The genus, consisting of a single species,[1] is West Indian, extending to southern Florida and to Venezuela.

The wood of Canella is very heavy and exceedingly hard, strong and close-grained, with numerous thin inconspicuous medullary rays; it is dark red-brown, the thick sapwood consisting of twenty-five to thirty layers of annual growth, light brown or yellow. The specific gravity of the absolutely dry wood grown in Florida is 0.9893, a cubic foot of the dry wood weighing 61.65 pounds.

The pale inner bark of Canella, under the name of *Cortex Canellæ albæ*, furnishes an aromatic stimulant and tonic.[2] It has a pleasant cinnamon-like odor, and a bitter acrid taste. It is now

[1] A second species (Plée, *Herb. Mus. Paris*, No. 720) from Maracaibo in Venezuela, described by Miers as *Canella obtusifolia* (*Contrib.* i. 118, t. 23, B.), is probably, as Baillon suggests, a variety of *C. alba*, from which it differs principally in its shorter leaves and in the shorter terminal inflorescence, ternately branched. The flowers have not been seen.

[2] Canella bark is now principally obtained from the Bahama Islands. Preparatory to the stripping, the bark is generally beaten with a stick for the purpose of removing the suberous outer layer; the inner bark is then separated by a further beating, peeled off and dried, and is then ready for export without further preparation. (Flückiger & Hanbury, *Pharmacographia*, 68.)

The drug was first described in 1605 by Clusius in the *Exoticorum Libri Decem.* (*Canella alba quorundam*, 78; *Lignum aromaticum*, 323; *Lignum seu potius Cortex aromaticus*, 324), by Parkinson in 1640, in the *Theatrum Botanicum* (*Canella alba*, 1581), and by J. Bauhin in 1650 in the *Historia Plantarum Universalis* (*Canella folio Momali punicæ*, i. lib. 4, 455; *Lignum aromaticum seu potius cortex Monardes*, i. lib. 4, 460; *Canella alba quorundam*, i. lib. 4, 461, also Ray, *Hist. Pl.* ii. 1802). It was early confounded with the bark of *Drimys Winteri*, a native of Patagonia, and was sold as Winter's bark previous to 1693. (Dale, *Pharmacologia*, 432.) It was well described by Pierre Pomet in 1694 (*Hist. Gen. Drog.* 130), who published a fanciful portrait of the tree. According to Pomet the bark

rarely used, except perhaps locally in medicine, and as a condiment by the negroes of the West Indies.

Canella, the diminutive of the Latin *cana* or *canna*, a cane or reed, was first applied to the bark of some old-world tree[1] from the form of a roll or quill which it assumed in drying, and was afterwards transferred to the West Indian tree.

was known in his time also as *Costus blanc* and *Costus corticus* or *corticosus*. The confusion regarding the tree discovered by Captain Winter on the shores of the Strait of Magellan in 1578 and the West Indian Canella lasted during two centuries. (Linnæus, *Mat. Med.* 66 ; Barham, *Hort. Am.* 209 ; Miers, *Ann. Nat. Hist.* ser. 3, i. 342.)

[1] Cassia bark was an article of commerce in London under the name of canel in the thirteenth century (Flückiger & Hanbury, *Pharmacographia*, 476) ; and the bark of the true Cinnamon (*Cinnamomum Zeylanicum*) was known in Europe as Canella bark before the introduction of West Indian canella.

CANELLA ALBA.

Cinnamon Bark. White Wood. Wild Cinnamon.

Canella alba, Murray, Linn. *Syst.* ed. 14, iv. 443. — Swartz, *Obs.* 190; *Trans. Linn. Soc.* i. 96, t. 8. — Willdenow, *Spec.* ii. 851. — Titford, *Hort. Bot. Am.* Suppl. iii. t. 10, f. 4. — De Candolle, *Prodr.* i. 563. — Descourtilz, *Fl. Med. Antil.* viii. 229, t. 568. — Hayne, *Arzen.* 9, t. 5. — Stevenson & Churchill, *Med. Bot.* ii. t. 66. — Woodville, *Med. Bot.* iv. 694, t. 234. — Lindley, *Med. Bot.* 116. — Carson, *Med. Bot.* i. 24, t. 16. — Griffith, *Med. Bot.* 181, f. 98. — A. Richard, *Fl. Cub.* 248. — Dietrich, *Syn.* iv. 811. — Miers, *Contrib.* i. 116, t. 23, A. — Grisebach, *Fl. Brit. W. Ind.* 109. — Chapman, *Fl.* 43. — Guibourt, *Hist. Drog.* ed. 7, iii. 621, f. 767. — Bentley & Trimen, *Med. Pl.* i. 26, t. 26. — Baillon, *Hist. Pl.* i. 164, f. 211–215. — Sargent, *Forest Trees N. Am.* 10*th Census U. S.* ix. 24.

Laurus Winterana, Linnæus, *Spec.* 371.

Winterania Canella, Linnæus, *Spec.* ed. 2, 636. — Poiret, *Lam. Dict.* Suppl. iii. 799, t. 399.

C. Winterana, Gærtner, *Fruct.* i. 377, t. 77.

C. laurifolia, Loddiges, *Cat.* — Sweet, *Hort. Brit.* 65. — Don, *Gen. Syst.* i. 679.

Canella alba attains in Florida a height of twenty-five to thirty feet, with a straight trunk eight or ten inches in diameter. On the mountains of Jamaica it is said to grow sometimes to the height of fifty feet. The principal branches are slender, horizontal and spreading, forming a compact round-headed top. The bark of the trunk is an eighth of an inch thick, light gray, the surface broken into many short thick scales rarely more than two to three inches long, and about twice the thickness of the pale yellow aromatic inner bark. The leaves are obovate, round or slightly emarginate at the apex, and contracted into a short stout grooved petiole; they are three and a half to five inches long, an inch and a half to two inches broad, bright deep green, and lustrous. The flowers open in the autumn, and the fruit ripens in March and April, when it is bright crimson, soft and fleshy, and is devoured by many birds.

Canella alba is widely distributed, and not uncommon on the Florida keys, where it was first discovered by Dr. J. L. Blodgett. It generally grows under the shade of larger trees in dense forests composed of Sideroxylon, Lysiloma, Swietenia, Bursera, Hypelate, Dipholis, and Nectandra.

Canella alba was one of the first American trees to attract the attention of Europeans,[1] and it is mentioned in the accounts of many of the early voyages to America.[2]

[1] *Cinnamodendron corticosum* (Miers, *Contrib.* i. 121, t. 24), a small tree of the mountain forests of Jamaica, of the same family and with the same properties, was doubtless confounded with the true Canella in the early accounts of that island. The bark of the two trees is not distinguished commercially, and the pharmaceutical descriptions of Canella bark published prior to 1528 cover in some cases at least the bark of Canella and of Cinnamodendron. (Flückiger & Hanbury, *Pharmacographia*, 19.)

[2] "Allí hallamos un arbol, cuya hoja tenia el mas fino olor de clavos que nunca ví, y era como laurel, salvo que no era ansí grande; yo ansí pienso que era laurel su especie." *La carta del Doctor Chanca, que escribió a la Ciudad de Sevilla.* Segunda viage de Colon, 1493. (*Select Letters of Christopher Columbus relating to four voyages to the New World*, Major's ed. 23.)

"Alcuni alberi che nel sapore & odore parevano di Cannella." Fernando Colombo, *Hist.* fol. 96, and "Alberi di Cannella selvatica," fol. 104.

Cinamomum sive Canella Peruana, C. Bauhin, *Pinax*, 409. — Ray, *Hist. Pl.* ii. 1563.

"There hath beene Cinnamon and something else given me as fruits of the islands." (Layfield in *Purchas his Pilgrimes*, 1174.)

De Arboribus, Jucaiæ, Nieremberg, *Hist. Nat.* 294.

De Cassia Lignea, Cinnamomo, seu Canella, Francisco Hernandez, *Nov. Pl. Hist.* (ed. Roma, 1651), lib. ii. cap. 11; *De Caninga arbore*, lib. ii. cap. 25 (and Ximenes, Spanish ed. Mexico, 1615).

De la Canella de nuestras Indias, Nicolas Monardes, *Hist. Med.* Sevilla, 1574, fol. 98.

"Ex concisis arboribus, cinamomi forma." (Peter Martyr, *Decades*, dec. i. 7.)

"They suppose to be the Cinnamon-tree." (*The Historie of the West Indies*, 77. English ed. of Peter Martyr's *Decades*.)

"Bois de Canelle," *Histoire Naturelle et Morale des Antilles de l'Amerique*, 80.

Canella alba Clusii, Jonston, *Dendrographias*, 166.

Canella Americana, Cubana, Jonston, *Hist. Nat. Arb.* (ed. Eckebrecht), i. 170.

"De la Canelle qui se trouve dans la grande terre de la Guadeloupe." (Du Tertre, *Hist. Gen. Antil.* ii. 145.)

Cassia Cinamomea, s. Cinamomum sylvestre Barbadensium Arbor baccifera fructu calyculato tetrapyreno, folio enervi, Plukenet, *Alm. Bot.* 89, t. 160, f. 7.

Cassia lignea Jamaicensis, Laureolæ foliis subcinereis, cortice Piperis modo acri, Plukenet, *Alm. Bot.* 89, t. 81, f. 1.

Cassia lignea Laurifolia, Americana, cortice albo, valde acri et aromatico, Plukenet, *Alm. Bot.* 89.

Arbor baccifera laurifolia aromatica, Sloane, *Phil. Trans.* xvii.

The white bark, the brilliant deep green foliage, and crimson fruit make the Canella one of the most ornamental of the smaller south Florida trees. It was introduced into England in 1738,[1] and was first cultivated in Europe by Philip Miller.[2]

465, t.; *Cat. Pl. Jam.* 165; *Nat. Hist. Jam.* ii. 87, t. 191, f. 2.— Catesby, *Nat. Hist. Car.* ii. 50, t. 50.

Winterania, Linnæus, *Hort. Cliff.* 488.

[1] Aiton, *Hort. Kew.* ii. 125.

[2] Philip Miller (1691–1771); "Hortulanorum princeps;" gardener of the Chelsea Physic Garden; author of the *Gardener's Dictionary*, of which eight editions were published during his life.

EXPLANATION OF THE PLATE.

Plate XX. Canella alba.

1. A flowering branch, natural size.
2. A fruiting branch, natural size.
3. Diagram of a flower.
4. A flower, enlarged.
5. Vertical section of a flower, enlarged.
6. A flower, the sepals and petals removed, enlarged.
7. An ovule, much enlarged.
8. Vertical section of a fruit, somewhat enlarged.
9. A seed, enlarged.
10. Vertical section of a seed, enlarged.
11. An embryo, much enlarged.

C.E. Faxon del. Picart fr. sc.

CANELLA ALBA, Murr.

A. Riocreux dirext. Imp. R. Taneur, Paris.

GORDONIA.

Flowers solitary, regular, perfect; sepals 5, hypogynous, unequal, imbricated; petals usually 5, hypogynous, imbricated; stamens pentadelphous or united into a tube. Capsules dehiscent; seeds exalbuminous.

Gordonia, Ellis, *Phil. Trans.* lx. 518, t. 11. — Linnæus, *Mant.* 556. — A. L. de Jussieu, *Gen.* 275. — Cambessedes, *Mém. Mus. Paris,* xvi. 408, t. 16, B. — Endlicher, *Gen.* 1022. — Meisner, *Gen.* 41. — Gray, *Gen. Ill.* ii. 101. — Bentham & Hooker, *Gen.* i. 186. — Baillon, *Hist. Pl.* iv. 252.

Franklinia, Marshall, *Arbust. Am.* 48.
Lacathea, Salisbury, *Parad. Lond.* No. 56.
Polyspora, Sweet, *Hort. Brit.* 61.
Carria, Gardner, *Calc. Jour. Nat. Hist.* vii. 7.
Antheischima, Korthals, *Verh. Nat. Gesch. Bot.* 137, t. 27.
Dipterospermum, Griffith, *Notul.* ix. 564.

Trees or shrubs, with watery juice. Leaves ample, alternate, pinnately veined, entire or crenate, exstipulate, sempervirent or membranaceous. Flowers long-peduncled or subsessile, solitary in the axils of the leaves, or collected at the ends of the branches. Calyx with two to five caducous bracts below the flower; sepals rounded, concave, coriaceous, graded from the bracts to the petals, persistent. Petals (rarely six or indefinite) alternate with the sepals, free or often slightly united with each other at the base and with the clusters of stamens, obovate, concave, white or rarely rose-colored, deciduous. Stamens indefinite, the clusters opposite the petals; filaments short and united at the base into a fleshy cup adnate with the base of the petals, or long and inserted directly on the petals; anthers inserted near their base, versatile, introrse, two-celled, the oblong cells opening longitudinally. Ovary sessile, three to five or rarely six-celled; style elongated, erect, simple, the stigmatic apex spreading; ovules anatropous, four to eight in each cell, pendulous in two series from the inner angle, collateral. Capsule woody, oblong or subglobose, five-celled, loculicidally five-valved, with a persistent axis angled by the projecting placentas. Seeds two to eight in each cell, pendulous, flat or compressed, the woody testa produced upwards into an oblong wing (rarely obsolete). Embryo mostly straight or oblique, with ovate flat or crumpled cotyledons; the short radicle superior.[1]

The genus Gordonia is confined to the south Atlantic states in North America, and to tropical Asia. Ten species are described; two are American, six occur in India[2] and the Malay peninsula, and one in southern China.[3] *Gordonia excelsa*[4] is common to the Indian and Malay peninsulas and the East Indian islands, where a second species occurs.[5]

Gordonia has few economic properties. The bark of the American *G. Lasianthus* is rich in tannin, and has been locally used in tanning leather. The wood of *G. obtusa*, a fine tree of the mountain forests of India, is manufactured into lumber and used for doors, rafters, and beams.[6]

[1] The genus has been divided into two sections: —

1. *Eugordonia*, with short filaments rising from the partly free summit and inner face of the thickened lobes confluent at the base into a fleshy cup, and a capsule pointed with the base of the short style, the valves entire, with four, or by abortion two, winged seeds in each cell.

2. *Franklinia*, with long filaments connate with the base of the petals; an elongated deciduous style; a capsule loculicidally five-valved from the obtuse apex to the middle, and septicidally five-valved from the base; and six to eight, or by abortion fewer seeds in each cell, their loose testa hardly produced into a wing. (Gray, *Gen. Ill.* ii. 103.)

[2] Thwaites, *Enum. Pl. Zeyl.* 40. — Hooker, f. *Fl. Brit. Ind.* i. 291.

[3] *Gordonia anomala*, Sprengel, *Syst.* iii. 126. — Bentham, *Fl. Hongk.* 29. — Forbes & Hemsley, *Jour. Linn. Soc.* xxiii. 80 (*Camellia axillaris*, *Bot. Reg.* t. 349. — *Bot. Mag.* t. 2047. — *Polyspora axillaris*, Sweet, *Hort. Brit.* 61. — Don, *Gen. Syst.* i. 574).

[4] Blume, *Bijdr.* iii. 130. — Miquel, *Fl. Ned. Ind.* i. 489.

[5] *Gordonia acuminata*, Miquel, *Fl. Ned. Ind.* i. 489.

[6] Beddome, *Fl. Syl. S. Ind.* t. 83. The wood is described "as

All the species bear handsome foliage and flowers, and are desirable ornamental plants. The American *G. Altamaha* is perhaps the most commonly found in gardens. *G. anomala* has long been cultivated under glass in Europe.

The genus Gordonia, founded by Ellis[1] on the American *G. Lasianthus*, was named by Dr. Alexander Garden[2] of Charleston, South Carolina, in honor of Dr. James Gordon[3] of Aberdeen. This honor was transferred, however, by Ellis to James Gordon,[4] a nurseryman at Mile End near London.

white with a straw tint, even-grained and pleasant to work, and not unlike beech ; it warps if not well seasoned."

[1] John Ellis (1710–1776), a London merchant, agent for West Florida and for Dominica ; a correspondent of Linnæus, and the author of the *Natural History of Corallines*, and of several papers on botany.

[2] Alexander Garden (1728–1791), a Scotch physician who resided in Charleston, South Carolina, for thirty years from 1752 ; a correspondent of Linnæus, Ellis, and Collinson. Dr. Garden returned to England on the breaking out of the Revolutionary War, and died in London.

[3] James Gordon, "a very ingenious and skillful physician and botanist who first interested me in these studies, and tinctured my mind very early with a relish for them." (Letter of Alexander Garden. Smith, *Correspondence of Linnæus*, i. 378.)

[4] James Gordon (d. 1780), nurseryman (1750–1776) ; introduced into England *Ulmus Americana* (1752), *Sophora Japonica* (1753), and the Ginkgo (1754) ; he was "bred under Lord Petre and Dr. Sherard, and knows systematically all the plants he cultivates. He has more knowledge in vegetation than all the gardeners and writers on gardening in England put together, but he is too modest to publish anything." (Letter of John Ellis to Linnæus. Smith, *Correspondence of Linnæus*, i. 93.)

CONSPECTUS OF THE NORTH AMERICAN SPECIES.

Flowers long pedunculate ; filaments united into a tube ; capsule ovoid ; seeds furnished with a membranaceous wing ; leaves evergreen . . . . . 1. G. Lasianthus.

Flowers subsessile ; filaments distinct ; capsule globose ; seeds without wings ; leaves membranaceous . . . . . 2. G. Altamaha.

GORDONIA LASIANTHUS.

Bay. Loblolly Bay.

FLOWERS on long slender peduncles; tube of the filaments short, 5-lobed, adnate to the base of the petals. Capsules ovoid; seeds winged. Leaves evergreen.

Gordonia Lasianthus, Ellis, *Phil. Trans.* lx. 518, t. 11; *Letters*, t. 2. — Linnæus, *Mant.* 570. — L'Heritier, *Stirp. Nov.* 156. — Cavanilles, *Diss.* ii. 307, t. 161. — Walter, *Fl. Car.* 177. — Bartram, *Trav.* 161. — Lamarck, *Dict.* ii. 770; *Ill.* iii. 146, t. 594, f. 1. — Swartz, *Obs.* 271. — Willdenow, *Spec.* iii. 840. — Michaux, *Fl. Bor.-Am.* ii. 42. — *Bot. Mag.* t. 668. — *Nouveau Duhamel*, ii. 236, t. 68. — Desfontaines, *Hist. Arb.* i. 484. — Michaux f. *Hist. Arb. Am.* iii. 131, t. 1. — Pursh, *Fl. Am. Sept.* i. 451. — Nuttall, *Gen.* ii. 84. — De Candolle, *Prodr.* i. 528. — Elliott, *Sk.* ii. 171. — Don, *Gen. Syst.* i. 573, f. 99. — Audubon, *Birds*, t. 168. — Reichenbach, *Fl. Exot.* t. 151. — Spach, *Hist. Veg.* iv. 79. — Loudon, *Arb. Brit.* i. 379, f. 93. — Torrey & Gray, *Fl. N. Am.* i. 223. — Gray, *Gen. Ill.* ii. 102, t. 140, 141. — Choisy, *Mém. Ternst. et Camel.* 51. — Payer, *Organ. Compt.* 533, t. 149, f. 1–23. — Chapman, *Fl.* 60. — Curtis, *Geolog. Surv. N. Car.* 1860, iii. 80. — Baillon, *Hist. Pl.* iv. 230, f. 254, 255; *Dict.* ii. 725, f. — Sargent, *Forest Trees N. Am.* 10*th Census U. S.* ix. 25. — Watson & Coulter, *Gray's Man.* ed. 6, 96.

Hypericum Lasianthus, Linnæus, *Spec.* 783. — Hill, *Veg. Syst.* xv. t. 1, f. 3.

G. pyramidalis, Salisbury, *Prodr.* 386.

A tree, sixty to seventy-five feet in height, with a tall straight trunk eighteen or twenty inches in diameter, and branches which generally grow upright at first, and then spread into a rather narrow compact head; or rarely a low shrub. The bark of the trunk of full-grown individuals is nearly an inch thick and deeply divided into regular parallel rounded ridges, their dark red-brown scaly surface broken into many regular shallow furrows. The bark of the stout branchlets, marked during several years with large circular leaf-scars, is dark brown and rugose, becoming furrowed during the second or third season. The winter-buds are narrowly acuminate and covered with pale silky hairs. The leaves are coriaceous, lanceolate-oblong, pointed and narrowed gradually at the base into stout channeled petioles, minutely crenately-toothed usually above the middle only, dark green, smooth and shining. The flowers, which begin to expand in July and continue to open successively during several weeks, are borne on slender peduncles two and a half to three inches long. The subfloral bracts, of which there are usually three or four, are ovate, minute and caducous. The sepals are ovate and a third to half an inch long by as much broad, fringed on the margins with short white hairs and covered on the outer surface with a dense velvet-like pubescence. The petals are rounded at the extremity, gradually and regularly contracted to the base, and silky puberulent on the back. They are white, an inch and a quarter to an inch and a half long and an inch broad. The staminal cup is fleshy, deeply five-lobed, and pubescent on the inner surface. The anthers are yellow. The ovary is pubescent, ovate, and gradually contracted into the stout style which equals the stamens in length. The seeds are flat, nearly square, slightly concave on the inner and rounded on the outer surface with a black rugose outer coat dotted with small pale brown excrescences. They are nearly one sixteenth of an inch long and half the length of the thin membranaceous oblong or oblique wing, which is pointed or rounded at the extremity and pale brown. The embryo fills the cavity of the seed, and is nearly straight. The cotyledons are oval, subcordate, foliaceous; the short radicle centripetal superior.

Gordonia Lasianthus is confined to the region adjacent to the south Atlantic and Gulf coasts. The most northern point where it is found growing naturally is in the southern part of Virginia; thence it extends south to Cape Malabar and Cape Romano in Florida, and westward to the valley of the Mississippi River. It is most common in Georgia and east Florida, much less common in west Florida and Alabama, and rare towards the western limits of its range.

Gordonia Lasianthus grows in shallow swamps or on moist springy lands, scattered with the Great Magnolia, the Red Bay, the Scarlet Maple, and other moisture-loving trees, through forests composed principally of the Water-gum; or with the Small Magnolia it almost exclusively occupies shallow depressions, often several hundred acres in extent, in the pine-barrens near the Atlantic coast. It is occasionally found in the sandy swamps which border the rivers of the Gulf coast, covered with almost impenetrable forests of the Water-gum, the White Cedar, the Devil-wood, and the Swamp Red Bay. On the poorest pine-lands of South Carolina, usually covered with a dense undergrowth of the Saw Palmetto, *Gordonia Lasianthus* is sometimes found blooming as a shrub, and on such soils it rarely grows to a height of more than three or four feet or lives more than a few years. *Gordonia Lasianthus* is never long-lived, and the insecure hold which the superficial roots have in the wet soil in which this tree grows causes it to be blown down easily after it reaches its full size.

The wood of *Gordonia Lasianthus* contains numerous thin medullary rays; it is light, soft and close-grained, but not strong or durable. The color of the heartwood is light red; when absolutely dry it has a specific gravity of 0.4728, a cubic foot of the dry wood weighing 29.47 pounds. The sapwood, consisting of forty to fifty thick layers of annual growth, is lighter colored. The wood is sometimes used in cabinet-making, for which purpose, were it not for its want of strength, its fine grain and good color would make it valuable.

Gordonia Lasianthus[1] was first described by Plukenet in the *Amaltheum Botanicum*.[2] It was introduced into England about 1768,[3] and is occasionally seen in gardens, although no great success has ever attended its cultivation.[4] It is precariously hardy in the United States as far north as Philadelphia.

[1] The Linnæan use of the capital in *Lasianthus* (hairy-flowered) is retained, although Linnæus's reason for so writing the word is not apparent. His quotation, "Lasianthus Gronovii vide Syst. Nat.," as a synonym under his species in the *Hortus Cliffortianus*, is not clear. The name does not appear in the first edition of the *Systema Naturæ*, the only one published before the *Hortus Cliffortianus*, and the only use of the word by Gronovius was in the *Flora Virginica*, where this phrase occurs as a note to his *Hypericum flore carneo:* "Lasiantho affinis foliis ovatis integris; flore specioso albo, exterius pubescente, fundo rubro, Clayt." (175). Linnæus, when it was found that this plant was not a Hypericum, seems to have suggested *Lasianthus* to Ellis as the generic name for it. The suggestion, however, came too late, as Ellis, writing to Linnæus on December 28, 1770, eight days after his paper on Gordonia was read before the Royal Society, regrets that "I cannot oblige you in changing the name Gordonia to Lasianthus." The characters of *Gordonia Lasianthus* are given in this letter. (Smith, *Correspondence of Linnæus*, i. 254.)

Loblolly, a loutish or foolish person, nautically loblolly-boy or surgeon's assistant, is a nautical name also for water gruel or spoon meat, and is applied to medicines collectively. It was early used in the West Indies as a plant name, and appears in Plukenet's *Almagestum Botanicum*, published in London in 1696, where this phrase occurs on page 38: "Arbor Indica baccifera Verbasci foliis lanuginosa, Loblolly Barbadensibus dicta." Plukenet's plant is *Cordia macrophylla*, Mill., which thus appears to be the first tree to which the name Loblolly was applied in print.

A Cupania, probably *C. glabra*, Sw., is called by Browne in the *Natural History of Jamaica*, published in 1789, "Loblolly-wood." In the description it is stated that "the wood is soft and useless, from whence its name." This seems to connect the name of loblolly, a soft, foolish person, or soft mixture of porridge, with a tree with soft wood. *Laplacea Hæmatoxylon*, Camb., *Pinus Cubensis*, Griseb., *Sciadophyllum Jacquinii*, Griseb., and *Pisonia subcordata*, Sw., are also, according to Grisebach (*Fl. Brit. W. Ind.*), called Loblolly. "Blolly," a corruption, no doubt, of Loblolly, is used by the inhabitants of the Florida keys, and probably by those of the Bahama Islands, as the common name of *Pisonia obtusata*, Sw.

Catesby first called *Gordonia Lasianthus* Loblolly Bay (*Nat. Hist. Car.*). The use of the name as applied to this tree is not, however, clear. Catesby may have given it the name from a fancied resemblance of the Gordonia to a West Indian tree seen by him on the Bahamas; or the name may have been used from the fact that old trees, attached to the ground by their lateral surface roots only, are easily blown down. The name is more common in books than it is in familiar use by the people of the southern states.

[2] *Alcea Floridana, quinquecapsularis Laurinis foliis, leviter crenatis, seminibus Coniferarum instar alatis*, 7, t. 352, f. 3. — Catesby, *Nat. Hist. Car.* i. 44, t. 44.

Hypericum floribus pentagynis, foliis lanceolatis serratis, Linnæus, *Hort. Cliff.* 380.

[3] *Gordonia Lasianthus* was first cultivated in England, according to Aiton (*Hort. Kew*, ii. 231), by a Mr. Benjamin Bewick, of whom I have no information in addition to that contained in the following extract from a letter from Ellis to Linnæus: "You must know then, that we have lately got into a method of cultivating that elegant evergreen, called in South Carolina and the Floridas the Loblolly Bay. This tree has lately produced some well-blown flowers in the curious botanic garden of Mr. Bewick at Clapham, near London, who was so obliging to send them to me to examine their character while fresh." (*Phil. Trans.* lx. 518; read December 20, 1770.)

[4] Loudon, *Arb. Brit.* i. 379.

EXPLANATION OF THE PLATE.

PLATE XXI. GORDONIA LASIANTHUS.

1. A flowering branch, natural size.
2. A fruiting branch, natural size.
3. Diagram of a flower.
4. Vertical section of a flower, natural size.
5. An anther, posterior view.
6. An anther, anterior view.
7. Vertical section of an ovary, enlarged.
8. An ovule, much enlarged.
9. Vertical section of a capsule, natural size.
10. Vertical section of a seed, enlarged.
11. An embryo, enlarged.
12. Cross section of an embryo, enlarged.

C.E.Faxon del. Picart fr. sc.

GORDONIA LASIANTHUS, L.

A. Riocreux direx.t Imp. R. Taneur, Paris.

GORDONIA ALTAMAHA.

Franklinia.

FLOWERS subsessile; filaments distinct. Capsule globose, septicidally 5-valved from the base to the middle; seeds destitute of wings. Leaves membranaceous, deciduous.

Gordonia Altamaha, Sargent, *Garden and Forest*, ii. 616.

Franklinia Altamaha, Marshall, *Arbust. Am.* 49. — Bartram, *Trav.* 16, 467. — Rafinesque, *Atlant. Jour.* 79, f.

G. pubescens, L'Heritier, *Stirp. Nov.* 156. — Lamarck, *Dict.* ii. 770. — Cavanilles, *Diss.* ii. 308, t. 162. — Willdenow, *Spec.* iii. 841. — Michaux, *Fl. Bor.-Am.* ii. 42. — Ventenat, *Jard. Malm.* t. 1. — *Nouveau Duhamel*, ii. 237. — Desfontaines, *Hist. Arb.* i. 484. — Michaux f. *Hist. Arb. Am.* iii. 135, t. 2. — Pursh, *Fl. Am. Sept.* ii. 451. — Nuttall, *Gen.* ii. 84. — Loiseleur, *Herb. Amat.* iv. t. 236. — Elliott, *Sk.* ii. 171. — De Candolle, *Prodr.* i. 528. — Don, *Gen. Syst.* i. 573. — Audubon, *Birds*, t. 185. — Spach, *Hist. Veg.* iv. 80. — Loudon, *Arb. Brit.* i. 380, f. 94. — Torrey & Gray, *Fl. N. Am.* i. 223. — Gray, *Gen. Ill.* ii. 102, t. 141, f. 11–14, t. 142. — Choisy, *Mém. Ternst. et Camel.* 51. — Chapman, *Fl.* 60. — Goodale & Sprague, *Wild Flowers*, 193, t. 47. — Sargent, *Forest Trees N. Am.* 10*th Census U. S.* ix. 25.

G. Franklini, L'Heritier, *Stirp. Nov.* 156. — Willdenow, *Spec.* iii. 841. — *Nouveau Duhamel*, ii. 237. — Desfontaines, *Hist. Arb.* i. 484. — Poiret, *Lam. Dict.* Suppl. ii. 816.

Michauxia sessilis, Salisbury, *Prodr.* 386.

Lacathea florida, Salisbury, *Parad. Lond.* t. 56. — Colla, *Hort. Ripul.* Appx. i. 134.

A tree or shrub, "fifteen or twenty feet high branching alternately,"[1] with stout slightly angled branchlets covered with dark red-brown bark, dotted with minute pale wart-like excrescences and conspicuously marked with large prominent leaf-scars. The scales of the stout acuminate winter-buds are covered with a thick pale silky tomentum. The leaves are obovate-oblong, rounded or pointed at the apex, and gradually and regularly narrowed at the base into a short grooved petiole; they are sharply serrate usually above the middle only, bright green and lustrous on the upper surface, and pale on the lower, and turn scarlet in the autumn before falling; they are five or six inches long and two inches broad. The flowers, which in Philadelphia begin to appear about the middle of September, continue to open until the buds are destroyed by frost. They are borne on short stout peduncles, at first pubescent, and finally glabrous, produced from the axils of the upper leaves, and marked with the broad conspicuous scars of the two minute lateral subfloral bracts, which are pubescent and early-deciduous. The sepals are nearly circular, half an inch long, with ciliolate margins, and are covered on the outer surface with short pale hairs. The white membranaceous petals, which before the expansion of the flower form a large spherical bud, are obovate with more or less crenulate margins; they are an inch or an inch and a half long by an inch broad, and are densely coated with fine pubescence on the outer surface. The anthers are yellow. The ovary is conspicuously ridged, pubescent, truncate, and crowned with the slender deciduous style which nearly equals the stamens in length. The seeds, six or eight, or by abortion fewer in each cell of the woody capsule, are closely packed together on the whole length of the thick axile placenta; they are nearly half an inch long and angled by mutual pressure. The embryo is not known.[2]

Gordonia Altamaha is not now known to grow anywhere naturally. It was discovered by John Bartram in 1765, during one of his journeys through the southern states, near Fort Barrington on the Altamaha River in Georgia, occupying with *Pinckneya pubens* an area of two or three acres. William Bartram, who had accompanied his father during the journey of 1765, revisited the Altamaha River eight years later, and again in 1778, and collected roots and seeds of the beautiful flowering tree which had so impressed his father and himself that they had thought it worthy of the name of Franklinia,

[1] Bartram, *Trav.* 467.

[2] I have never seen the bark of an old plant of Franklinia, or been able to examine its wood.

which they proposed for it in honor of their distinguished friend and neighbor, Benjamin Franklin.[1] Dr. Moses Marshall[2] visited the same locality in 1790 and saw Franklinia. No botanist since 1790, however, has seen the plant growing wild, and all efforts to find it in the original locality or elsewhere have been unsuccessful.[3]

Gordonia Altamaha was introduced into gardens by the Bartrams,[4] and reached England as early as 1774.[5] In cultivation it forms a low spreading shrubby tree, with a short stout trunk covered with smooth dark brown bark. It is hardy in the United States as far north as Philadelphia, and flourishes in England and in central Europe. It grows well in rich light loam near water, and may be propagated by layers.

[1] William Bartram, *Trav.* 16, 467.

[2] Moses Marshall (1758–1813), a nephew of the distinguished West Chester botanist, Humphrey Marshall, author of the *Arbustum Americanum*, with whom he was associated during several years in botanical enterprises, made several long exploring journeys through the southern and southwestern parts of the country for the purpose of collecting plants and seeds for English correspondents.

[3] W. H. Ravenel, *Am. Nat.* xvi. 235.

[4] All the specimens of Franklinia in cultivation are descendants of the plants collected by the Bartrams and by Marshall, or of those raised from the seed gathered by William Bartram in 1778. The specimen planted by John Bartram in his garden near Philadelphia was described as fifty feet high by William Wynne, writing to Loudon's *Gardener's Magazine* (viii. 272) in November, 1831, when the tree was in flower. A notice of this tree, or perhaps of a younger one, as it is said to be only about thirty feet in height, was published in 1853 by Mr. Thomas Meehan in *The American Hand Book of Ornamental Trees*, 127. The large tree in Bartram's garden was blown down a few years ago. There is one of its descendants, now about twenty-five feet high, in the garden of Mr. William De Hart in Philadelphia, and there are trees nearly as large in Fairmount Park in that city, and in the nurseries of Mr. Thomas Meehan at Germantown. Our figure has been made from specimens from the Germantown tree.

[5] Aiton, *Hort. Kew.* ii. 231.

EXPLANATION OF THE PLATE.

PLATE XXII. GORDONIA ALTAMAHA.

1. A flowering branch, natural size.
2. A fruiting branch, natural size.
3. Diagram of a flower.
4. Vertical section of a flower, natural size.
5. A stamen, enlarged.
6. A pistil, enlarged.
7. An ovule, much enlarged.
8. Vertical section of a carpel, natural size.
9. A seed, natural size.

C.E.Faxon del. Picart fr. sc.

GORDONIA ALTAMAHA, Sarg.

A.Riocreux dirext. Imp R. Taneur, Paris.

FREMONTIA.

Flowers solitary, terminal or opposite the leaves; calyx hypogynous, subcampanulate, deeply 5-lobed, the lobes imbricated in æstivation, persistent; petals 0; stamens 5, united into a column. Capsule 4 to 5-valved, loculicidally dehiscent.

Fremontia, Torrey, *Smithsonian Contrib.* vi. 5. — Bentham & Hooker, *Gen.* i. 212, 982. — Gray, *Proc. Am. Acad.* n. ser. xxii. 304.

Cheiranthodendron, Baillon, *Hist. Pl.* iv. 127, in part.

A tree or shrub, with stellate pubescence and mucilaginous inner bark. Leaves alternate, palmately lobed, furnished with minute deciduous stipules, thick, prominently veined, usually rufous on the lower surface. Flowers petiolate, subtended by three or rarely five minute caducous bracts. Calyx cleft nearly to the base, the yellow lobes spreading, obovate, often mucronate, an inch long, the three outer a little smaller, pubescent on the outer surface, with a hairy cavity at the base of the inner surface. Staminal column divided to the middle into five slender divisions alternate with the sepals, each bearing on its summit an adnate oblong-linear curved extrorse two-celled anther, longitudinally dehiscent. Ovary five-celled, the cells opposite the sepals; style filiform, elongated, terminated by an acute undivided stigmatic point; ovules numerous in each cell, horizontal, anatropous. Capsule ovate, acuminate, an inch long, densely coated with long stinging hairs, the inner surface of the four or five cells villose pubescent. Seeds oval; testa crustaceous, minutely pubescent, furnished with a small fleshy marginal deciduous arilloid appendage on the chalaza. Embryo straight, in thick fleshy albumen; cotyledons oblong, foliaceous, three or four times longer than the short radicle.

Fremontia[1] is represented by a single California species.

FREMONTIA CALIFORNICA.

Slippery Elm.

Fremontia Californica, Torrey, *Smithsonian Contrib.* vi. 5, t. 2, f. 2; *Proc. Am. Assoc.* iv. 191; *Pacific R. R. Rep.* iv. 15, 71. — Newberry, *Pacific R. R. Rep.* vi. 68. — Walpers, *Ann.* iv. 319. — Gray, *Jour. Bost. Soc. Nat. Hist.* vii. 146. — *Bot. Mag.* t. 5591. — Lemaire, *Ill. Hort.* xiii. t. 496. — *Belg. Hort.* xvii. 226, t. 13. — Carrière, *Rev. Hort.* 1867, 91, t. — Koch, *Dendr.* i. 483. — Masters, *Gard. Chron.* 1869, 610. — Seemann, *Jour. Bot.* vii. 297. — *Garden*, iii. 54, t. — Planchon, *Fl. des Serres*, xxii. 175, t. — Brewer & Watson, *Bot. Cal.* i. 88; ii. 437. — Rothrock, *Wheeler's Rep.* vi. 41, 357.

Cheiranthodendron Californicum, Baillon, *Hist. Pl.* iv. 70.

A small tree, twenty to thirty feet high, with a short stout trunk twelve or fourteen inches in diameter, and stout rigid branches spreading almost at right angles with the stem; or more often a low intricately branched shrub. The bark of the trunk is rarely more than a quarter of an inch thick; it is

[1] The nearest ally to Fremontia is the Mexican Hand-tree, *Cheiranthodendron platanoides*, Bail., which differs from Fremontia in its large subfloral bracts, its more deeply pitted purple calyx, and its oblique staminal tube with connectives produced beyond the anthers. Baillon, in spite of these differences, unites Fremontia with Cheiranthodendron, while Gray retains the genus, and forms a new family, *Cheiranthodendreæ*, founded primarily on the strongly quincuncial calyx, for these two genera, which he removes from *Sterculiaceæ* and *Malvaceæ*. (*Proc. Am. Acad.* n. ser. xxii. 303.)

deeply furrowed, the dark red-brown surface broken into numerous short thick scales; that of the stout terete branchlets thickly coated, when they first appear, with rufous pubescence, is light red-brown. The leaves are usually three-lobed, rarely entire, or sometimes five to seven-lobed, an inch and a half across, and are borne on stout petioles a half to two thirds of an inch long. The flowers, which appear in July, are produced in the greatest profusion from short spur-like lateral branches.

Fremontia Californica grows on the lower slopes of the California mountains from Mariposa, at least, to Lower California. It is nowhere very common west of the Sierra Nevada, although it reaches its greatest size on the foothills of the western slope of these mountains. East of the Sierra Nevada, in the region of the Mohave Desert, Fremontia is much more common, always growing as a low shrub, and sometimes forming thickets several acres in extent, which may be seen miles away when the plants are covered with their brilliant yellow flowers. Here the ordinary associates of Fremontia in the dry gravelly and rocky soil are *Garrya flavescens*, *Prunus fasciculata*, *Ceanothus cuneatus*, *Purshia tridentata*, *Aplopappus monactis*, *Lycium Cooperi*, and the other shrubs of the California desert, while above it on the higher slopes appear open stunted forests of the Desert Nut Pine (*Pinus monophylla*). West of the Sierras Fremontia grows also in dry gravelly soil, generally occupying the slopes of narrow valleys with *Quercus dumosa*, various species of Ceanothus, *Prunus ilicifolia*, *Cercocarpus parvifolius*, the Manzanitas, etc.

The wood of *Fremontia Californica* contains numerous groups of small ducts parallel with the thin conspicuous medullary rays. It is hard, heavy, close-grained, and dark brown tinged with red; the the thick sapwood is lighter colored. The specific gravity of the absolutely dry wood is 0.7142, a cubic foot of the dry wood weighing 44.50 pounds.

The mucilaginous inner bark of Fremontia is sometimes used in California in poultices; and its resemblance to the bark of the Red Elm of the eastern states caused the tree to be called Slippery Elm by the early settlers of the region it inhabits.

Fremontia Californica was discovered in the spring of 1846 by Frémont, whose service to botany the genus commemorates, during his third transcontinental journey.[1] It was introduced into cultivation in 1851 by James Veitch & Sons, the London nurserymen, and flowered in their establishment in 1865.

[1] More recent collections than Frémont's do not extend the range of Fremontia north of Mariposa, and the authority for Pitt River and northern California, published stations for the plant, appears to rest only on Frémont's collection. But the labels attached to his specimens give no indication of the place where they were discovered. It was probably in the central part of the state.

EXPLANATION OF THE PLATE.

PLATE XXIII. FREMONTIA CALIFORNICA.

1. A flowering branch, natural size.
2. A fruiting branch, natural size.
3. Diagram of a flower.
4. A flower, cut vertically through the staminal tube.
5. An anther, posterior view, enlarged.
6. An anther, anterior view, enlarged.
7. Vertical section of an ovary, enlarged.
8. An ovule, much enlarged.
9. Vertical section of a capsule, natural size.
10. A seed, enlarged.
11. Vertical section of a seed, enlarged.
12. Cross section of a seed, enlarged.
13. An embryo, much enlarged.
14. An epidermal stellate scale, much enlarged.

C.E.Faxon del. Picart fr. sc.

FREMONTIA CALIFORNICA, Torr.

A.Riocreux direx.t Imp.R.Taneur, Paris.

TILIA.

FLOWERS in axillary or terminal cymes, regular, perfect; sepals 5, distinct, valvate in æstivation, hypogynous, deciduous; petals 5, imbricated in æstivation, hypogynous; stamens numerous, polyadelphous or free. Fruit globose, indehiscent, 1 to 2-seeded.

Tilia, Linnæus, *Gen.* 156. — A. L. de Jussieu, *Gen.* 292. — Adanson, *Fam. Pl.* ii. 382. — Endlicher, *Gen.* 1008. — Gray, *Gen. Ill.* ii. 91. — Bentham & Hooker, *Gen.* i. 236. — Bocquillon, *Mém. Til.* 18. — Baillon, *Hist. Pl.* iv. 185.

Trees, with terete slender branches, mucilaginous juice, and tough fibrous inner bark. Leaves conduplicate in vernation, petiolate, alternate and two-ranked, usually obliquely cordate or truncate at the base, acute, serrate, and furnished with membranaceous ligulate caducous stipules. Peduncle connate to the middle with the axis of a membranaceous light green ligulate and persistent conspicuously reticulate-veined bract, and bearing minute caducous bracts at the base of the branches of the terminal cyme. Flowers nectariferous, fragrant. Sepals lanceolate. Petals alternate with the sepals, oblong-obovate or spatulate, the narrow base sometimes thickened and glandular, creamy white, deciduous. Stamens inserted on a short hypogynous receptacle; filaments filiform, distinct, or collected into five clusters and united at the base with each other and with a spatulate petaloid scale[1] placed opposite each petal; anthers fixed by the middle, two-celled, extrorse, the oblong cells separated by the forking of the filament. Ovary sessile, five-celled, the cells opposite the sepals; style erect, the dilated summit with five introrsely stigmatic spreading lobes; ovules two in each cell, ascending from the middle of its inner angle, semi-anatropous, the micropyle centripetal-inferior. Fruit nut-like, woody, globular or ovoid, sometimes ribbed, one-celled by the obliteration of the partitions. Seeds obovate, semi-anatropous, ascending; testa cartilaginous; albumen fleshy. Embryo large, often curved; cotyledons foliaceous, reniform or cordate, palmately five-lobed, the margins irregularly involute or crumpled; the radicle inferior.

The genus Tilia[2] is widely distributed in the temperate regions of the northern hemisphere, occurring in all its great geographico-botanical regions with the exception of western America, central Asia, and the Himalayas. It is represented in eastern North America by four species, of which one is Mexican.[3] Six or seven species are found in Europe[4] and the Orient,[5] and six species are known in China, Manchuria, and Japan.[6]

Tilias are trees generally of large size,[7] with soft straight-grained pale-colored light wood unable

[1] Bocquillon conceived this scale to be the upper part of the staminal receptacle projected into a petaloid body. To Baillon it was the terminal interior and sterile stamen of the fascicle developed into a petaloid scale.

[2] Tilia appears first in the ancient Tertiary formations of Grinnell Land in 82° north latitude, and Spitzbergen, where *Tilia Malmgreni*, Heer, is found. This species, which existing Tilias of Europe and America resemble, is believed by Saporta to be the ancestor from which the Lindens of the two continents have descended. (*Origine Paléontologique des Arbres*, 276, f. 39.)

[3] *T. Mexicana*, Schlechtendal, *Linnæa*, xi. 376. — Hemsley, *Bot. Biol. Am. Cent.* i. 141.

[4] Nyman, *Conspect. Fl. Europ.* 130.

[5] Boissier, *Fl. Orient.* i. 846.

[6] Franchet & Savatier, *Enum. Pl. Jap.* i. 66. — Maximowicz, *Bull. Acad. Sci. St. Pétersbourg*, x. 584. — Forbes & Hemsley, *Jour. Linn. Soc.* xxiii. 94. Dr. A. Henry's explorations in western China have recently added two fine Lindens to the Chinese flora.

[7] Accounts of several remarkable European Linden-trees have been published. The trunk of a tree planted in the town of Fribourg in 1476 to commemorate the battle of Morat attained a diameter of thirteen feet nine inches in 354 years. The Linden-tree of Trons in the Grisons, a celebrated tree as early as 1424, had a trunk fifty-one feet in circumference in 1798, and was believed by De Candolle to be 583 years old. The trunk of the Linden of Villars-en-Moing, near Morat, was thirty-eight feet in circumference four

to withstand decay when exposed to the elements, but esteemed and largely used for the interior finish of buildings, for cabinet-making, for the sounding boards of pianos, for wood carving, and for all kinds of wooden ware, and in the United States for the manufacture of paper, and the shavings used in stuffing furniture. The principal economic value of Tilia is in the tough inner bark or bast. This was used by the ancients for paper and for mats and in tying garlands,[1] and is now largely manufactured into mats, cords, fish-nets, coarse cloth, and shoes, especially in some parts of Russia and in Sweden where forests of Tilia abound.[2] The leaves of the different Tilias are gathered in some European countries and fed, either fresh or dried, to cattle,[3] and the young branches of *Tilia heterophylla* are cut in winter in the mountain regions of the southern United States for the same purpose. Lime-flower oil, or Linden oil,[4] obtained by distilling the flowers of the European Tilias, has a pleasant odor and is used in perfumery. An infusion of the flowers is a popular domestic remedy in some European countries in the treatment of indigestion, nervousness, and hysteria.[5] The flowers yield large quantities of nectar, and honey made near forests of Tilia is unsurpassed in flavor and delicacy.

Tilias, especially the species of western Europe,[6] have for centuries been favorite shade and ornamental trees, particularly in Europe at the period when the formal style of gardening, under the inspiration of Le Nôtre, prevailed; and avenues of Lime-trees were long considered an essential feature in every park and town of central and northern Europe. The ability of the Lindens to thrive with severe pruning renewed year after year fit them for the decoration of formal gardens, and their free habit when allowed to grow naturally makes them desirable park and roadside trees. The Tilias of eastern Europe,[7] less known in cultivation, are all beautiful hardy trees.[8] Numerous varieties of the European Tilia have appeared in gardens, especially among seedlings of *Tilia platyphyllos*, and are cultivated for their abnormal habit or curious foliage.

Tilias grow freely and rapidly in cultivation, flourishing in strong rich soil; they may be propagated by grafting or by layers as well as from seed. They are subject, however, to the attacks of many insects which sometimes destroy the trees by boring into the trunk, or disfigure them by devouring the foliage.[9]

feet from the ground in 1830, and was estimated to have lived 864 years. More famous still is the Linden of Neustadt on the Kocher in Würtemberg, which was large enough in 1550 to require stone columns to support its enormous branches. This tree had, in 1664, a trunk thirty-seven feet four inches in circumference, and was computed to be from 800 to 1,000 years old. (*Notice sur la Longévité des Arbres*, A. P. de Candolle, *Bib. Univ.* xlvii. 61. — *Scientific Papers*, Asa Gray, ii. 89.)

[1] Horace, *Odes*, i. 38, 2. — Ovid, *Fasti*, v. 337. — Pliny, xvi. 14, 25; xxiv. 8, 33.

[2] Trees twelve to twenty years old are usually cut in Russia for bast, generally in May or June when the sap is flowing freely and the bark can be most easily removed. It is divided into longitudinal strips four to six feet long, loosened with a sharp knife, and then torn off by hand and spread on the ground to dry. The bark is then soaked in water, when the liber is easily separated from the coarse cortical layers.

Linden-bast is exported from Russia principally in the form of mats six feet long and three and a half feet wide. They are used in packing machinery, furniture, and other large objects, and by gardeners for tying their plants. The Russian product of bast mats is estimated at 14,000,000 pieces, a large part being exported. The principal domestic use of bast in Russia is in shoemaking, several million pair of bast shoes being made in the governments of Nijnii-Novgorod, Wiatka, Kostroma, and Minsk. (Spone, *Encyclopædia of Industrial Arts, Manufactures, and Commercial Products*, 999.)

[3] Linnæus, *Iter. Scand.* 256. — Ventenat, *Mém. Acad. Sci.* iv. 18. Linnæus observed that the milk of cows fed on the leaves of Tilia was of poor quality and had a disagreeable flavor.

[4] Henry Watts, *Dict. Chemistry*, iii. 696. — Spone, *Encyclopædia of Industrial Arts, Manufactures, and Commercial Products*, 1424.

[5] Stillé & Maisch, *Nat. Dispens.* ed. 2, 1430.

[6] *Tilia platyphyllos*, Scopoli, *Fl. Carn.* i. 373. — *Garden and Forest*, ii. 256, f. 109 (*T. paucifolia*, Hayne, *Abbild. Holz.* 145, t. 108). *Tilia ulmifolia*, Scopoli, *Fl. Carn.* i. 374. — *Garden and Forest*, ii. 257, f. 111 (*T. parvifolia*, Hayne, *Abbild. Holz.* 141, t. 106). *Tilia vulgaris*, Hayne, *Abbild. Holz.* i. 144, t. 107. — *Garden and Forest*, ii. 256, f. 110.

[7] *Tilia argentea*, De Candolle, *Cat. Pl. Hort. Monsp.* 150 (*T. alba*, Waldstein & Kitaibel, *Pl. Rar. Hung.* i. 2, t. 3. — Reichenbach, *Fl. Ger.* vi. 60, t. 324). *Tilia petiolaris*, De Candolle, *Prodr.* i. 514. — *Bot. Mag.* t. 6737. *Tilia dasystyla*, Loudon, *Arb. Brit.* i. 366. — Bayer, *Verhandl. Bot. Verein, Wien*, xii. 39, t. 9, f. 2 (*T. euchlora*, C. Koch, *Dendr.* i. 473).

[8] Two or three Asiatic species of Tilia have been introduced into the United States and Europe. Their introduction, however, is so recent that it is impossible to speak of their hardiness or of their value as ornamental trees.

[9] The different species appear to be attacked by the same insects. All the American and European species are liable in America to injury by a borer, *Saperda vestita*. (Harris, *Injurious Insects*, 109.) The larvæ of two species of moth, *Cossus ligniperda* and *Zeuzera æsculi*, bore into the wood of Lindens and other trees. The Zeuzera has become naturalized in the United States, and has been found

Tilia (φιλύρα), the classical name of the Linden-tree[1] adopted by Tournefort[2] for this genus, was retained by Linnæus.

attacking Elm-trees in New Jersey. (*Garden and Forest*, iii. 30, f. 6.) The foliage of Lindens in some American cities is frequently destroyed by *Orgyia leucostigma*. The different Tilias are often injured by the fall Web-worm (*Hyphantria cunea*), the Forest Tent-caterpillar (*Clisiocampa sylvatica*), by an Inch-worm (*Hibernia tiliaria*), and by a Leaf-beetle (*Chrysomela scalaris*). They are much infested in Europe by the larva of a moth (*Ocneria dispar*). It has been introduced into the United States, and is abundant at Medford, Massachusetts (*Bull. Exp. Sta. Mass. Agric. Coll.* No. 7, 18). Several species of Aphides often occur in large numbers, and seriously disfigure the foliage of Linden-trees, and red mites (*Tetranychus*) live on these trees in America and in Europe, where they are sometimes so abundant as to "almost denude the trees of their foliage." (A. Murray, *Economic Entomology, Aptera*, 107.) Lists of the insects infesting Tilia in Europe can be found in Kaltenbach's *Die Planzen-Feinde aus der Classe der Insecten*, 70; and of those found on these trees in America in A. S. Packard's *Insects Injurious to Forest and Shade Trees* (*Bull.* 7, *U. S. Dept. of Interior*, 124).

[1] Lime, previous to about the year 1700, appears to have been usually written Line (Line-grove, Shakespeare, *Tempest*, v. 10), a corruption of Lind which by the suffix *en* becomes Linden or Linden-tree. The family name of Linnæus was derived from that of the Linden-tree.

[2] *Elémens de Botanique*, 484, t. 381.

CONSPECTUS OF THE NORTH AMERICAN SPECIES.

Stamens united to a petaloid scale.

Leaves green on both surfaces.

Leaves glabrous or nearly so; fruit ovoid . . . . . 1. T. AMERICANA.

Leaves pubescent on the under surface; fruit globose . . . . . 2. T. PUBESCENS.

Leaves pale on the lower surface; fruit globose . . . . . 3. T. HETEROPHYLLA.

MISSOURI BOTANICAL GARDEN.

TILIA AMERICANA.

Linden. Basswood.

LEAVES green on both surfaces, pubescent only in the axils of the principal veins. Pedunculate bract usually tapering at the base. Fruit ovoid.

Tilia Americana, Linnæus, *Spec.* 514. — Miller, *Dict.* ed. 8, No. 8. — Du Roi, *Harbk. Baum.* ii. 467. — Marshall, *Arbust. Am.* 153. — Wangenheim, *Nordam. Holz.* 55. — Willdenow, *Spec.* ii. 1162. — Desfontaines, *Hist. Arb.* ii. 37. — Persoon, *Syn.* ii. 66. — Michaux f. *Hist. Arb. Am.* iii. 311, t. 1. — Watson, *Dendr. Brit.* ii. 134, t. 134. — Torrey, *Fl. N. Y.* i. 116. — Loudon, *Arb. Brit.* i, 373, t. — Torrey & Gray, *Fl. N. Am.* i. 239. — Bigelow, *Fl. Boston.* ed. 3, 227. — Emerson, *Trees Mass.* ed. 2, ii. 584, t. — Gray, *Gen.* ii. 92, t. 136; *Proc. Am. Acad.* n. ser. xxii. 305. — Darlington, *Fl. Cestr.* ed. 3, 38. — Payer, *Organ. Compt.* t. 18. — Chapman, *Fl.* 59. — Curtis, *Rep. Geolog. Surv. N. Car.* 1860, iii. 79. — Koch, *Dendr.* i. 480. — Sargent, *Forest Trees N. Am.* 10*th Census U. S.* ix. 26. — Watson & Coulter, *Gray's Man.* ed. 6, 101.

T. Caroliniana, Miller, *Dict.* ed. 8, No. 4. — Du Roi, *Harbk. Baum.* ii. 469. — Wangenheim, *Nordam. Holz.* 56. — Marshall, *Arbust. Am.* 154.

T. nigra, Borkhausen, *Handb. Forstbot.* ii. 1219. — Bayer, *Verhandl. Bot. Verein, Wien,* xii. 53. — Spach, *Hist. Veg.* iv. 27.

T. glabra, Ventenat, *Mém. Acad. Sci.* iv. 9, t. 2. — *Nouveau Duhamel,* i. 228. — Poiret, *Lam. Dict.* vii. 681. — Pursh, *Fl. Am. Sept.* ii. 362. — Nuttall, *Gen.* ii. 3. — De Candolle, *Prodr.* i. 513. — Hayne, *Dendr. Fl.* 112. — Elliott, *Sk.* ii. 2. — Guimpel, Otto & Hayne, *Abbild. Holz.* 55, t. 45. — Dietrich, *Syn.* iii. 237. — Hooker, *Fl. Bor.-Am.* i. 108. — Don, *Gen. Syst.* i. 553. — Darlington, *Fl. Cestr.* ed. 2, 312. — Richardson, *Arct. Exped.* 422.

T. latifolia, Salisbury, *Prodr.* 367.

T. Canadensis, Michaux, *Fl. Bor.-Am.* i. 306. — Persoon, *Syn.* ii. 66. — Poiret, *Lam. Dict.* vii. 683.

T. pubescens, *Nouveau Duhamel,* i. t. 51 (not Aiton).

T. stenopetala, Rafinesque, *Fl. Ludovic.* 92. — Robin, *Voyage,* iii. 484.

T. neglecta, Spach, *Ann. Sci. Nat.* ser. 2, ii. 340, t. 15; *Hist. Veg.* iv. 29. — Walpers, *Rep.* i. 359.

A tree, usually sixty to seventy, or sometimes one hundred and twenty to one hundred and thirty feet in height, with a tall slender trunk three or four feet in diameter, and slender, often pendulous branches, the ultimate divisions spreading nearly at right angles. The bark of the trunk is about an inch thick, furrowed, the light brown surface broken into small thin scales. The bark of the branchlets is smooth, light gray, faintly tinged with red, and marked with numerous oblong dark wart-like excrescences; it becomes darker in the second year, and in the third is dark gray or brown and conspicuously rugose. The dark red winter-buds are stout, ovate, and pointed. The leaves are obliquely cordate or sometimes almost truncate at the base, the acuminate apex often contracted into a long slender point, sharply and deeply glandular-serrate, glabrous, with the exception of the tufts of rusty brown hairs on the lower surface in the axils of the principal veins; they are thick and firm, lustrous on the upper surface, five or six inches long, three or four inches broad, and are borne on slender petioles an inch and a half or two inches long. They turn pale yellow in the autumn before falling. The pedunculate bract is four or five inches long, an inch or an inch and a half broad, rounded or pointed at the apex, and tapering usually to a short-stalked base. The cyme of flowers is produced on a peduncle three and a half to four inches long. The flowers, borne on slender slightly angled pedicels, open during the first weeks of July from buds slightly angled by the reduplicate margins of the sepals, and densely coated with white tomentum. The sepals are densely hairy at maturity on the inner, and minutely pubescent on the outer surface. The ovary is hairy, and the fruit, tipped with the remnants of the style, is densely covered with short rufous tomentum. The seed is nearly a quarter of an inch long.

The northern limits of *Tilia Americana* are in northern New Brunswick; thence it extends west to the eastern shore of Lake Superior, and then northward and westward to the southern shore of Lake Winnipeg and to the valley of the Assiniboine River.[1] It extends southward through the Atlantic

[1] Robert Bell, *Rep. Geolog. Surv. Can.* 1878–80, 35.

states to Virginia and along the Alleghany Mountains to Alabama and Georgia, and west in the United States to eastern Dakota, eastern Nebraska and Kansas, the Indian Territory and eastern Texas.

Tilia Americana is one of the most common trees in the northern forest. It occupied, before the country was generally cleared, large tracts of the richest land to the exclusion of other trees, or often formed two thirds of the forest growth. Its usual associates in the forest, when it grows with other trees, are the Sugar Maple, the White Elm, the White Oak, and the Hickories. It is less common towards the southern and western limits of its range than it is near the northern boundary of the United States; reaching, however, its greatest size on the bottom-lands of the streams which flow from the north into the lower Ohio River.[1]

The wood of *Tilia Americana* contains numerous obscure medullary rays; it is light brown, faintly tinged with red, and hardly distinguishable from the thick sapwood consisting usually of from fifty-five to sixty-five layers of annual growth. The specific gravity of the absolutely dry wood is 0.4525, a cubic foot of the dry wood weighing 28.20 pounds. It is largely sawed into lumber, and under the name of whitewood is used in the manufacture of wooden ware, cheap furniture, the panels and bodies of carriages, and the inner soles of shoes. It is one of the woods principally used in America in the manufacture of paper pulp, the quick decomposition of the sap, however, making it unfit for white paper. The inner bark is occasionally made into coarse cordage and matting, although this industry has never attained any importance in the United States.

The earliest mention of the Linden in America appears in the remonstrance carried to Holland in 1649 by a delegation of the citizens of New Netherland under the lead of Adrien Van der Donck, and printed at the Hague in 1650.[2] It was described by Plukenet[3] in 1700, and was first sent to England by Catesby, and cultivated at Chelsea by Philip Miller in 1752.[4]

The large size which the American Linden attains in good soil,[5] its graceful habit, rapid growth, ample dark green foliage and fragrant flowers, make it one of the most desirable ornamental trees in the northern part of the United States, where it suffers less from insects than any of the foreign species which have been planted there. Several Lindens have appeared in European nurseries which must be considered varieties of the American Linden, or as hybrids influenced by it.[6]

[1] Ridgway, *Proc. U. S. Nat. Mus.* 1882, 61.

[2] "There are three varieties of beech, — water beech, common beech, and hedge beech, — also axe-handle wood, two species of canoe wood, ash, birch, fir, fire-wood, wild cedar, linden, alder, willow, thorn, elder, and many other kinds, useful for various purposes, but unknown to us by name, and which the carpenters will be glad to submit for examination." (*Representation from New-Nether-Land, Concerning the Situation, Fruitfulness, and poor Condition of the same.* English ed. Henry C. Murphy, 14.)

"The Line-tree with long nuts, the other kind I could never find; the wood of this Tree, Laurel, Rhamnus, Holly, and Ivy, are accounted for woods that cause fire by attrition." (*An Account of Two Voyages to New England*, by John Josselyn, Gent., 69, 1675.)

[3] *Tilia amplissimis glabris foliis, nostrati similis, ex Terra Mariana, Alm. Bot. Mant.* 181.

Tilia foliis majoribus mucronatis, Clayton, *Fl. Virgin.* 58. — Duhamel, *Traité des Arbres*, ii. 334.

Tilia foliis cordatis acuminatis serratis, subtus pilosis floribus nectario instructis, Miller, *Dict.* ed. 6, No. 3.

Tilia foliis cordatis obliquis glabris subserratis cum acumine, floribus nectario instructis, Miller, *Dict.* ed. 6, No. 4.

[4] Aiton, *Hort. Kew.* ii. 229.

[5] *Tilia Americana* is known in some parts of the country as Lime-tree, Whitewood, Lin, and Bee-tree.

[6] *Tilia Americana Moltke.* — *Tilia hybrida superba*, etc.

EXPLANATION OF THE PLATES.

Plate XXIV. Tilia Americana.

1. A flowering branch, natural size.
2. Diagram of a flower.
3. A flower, with two of the sepals and petals removed, enlarged.
4. A cluster of stamens, with their petaloid scale, enlarged.
5. A stamen enlarged.
6. Vertical section of an ovary, enlarged.
7. A cross section of an ovary, enlarged.
8. An ovule, much enlarged.

Plate XXV. Tilia Americana.

1. A fruiting branch, natural size.
2. Vertical section of a fruit, enlarged.
3. Cross section of a fruit, enlarged.
4. A seed, enlarged.
5. An embryo, with the five-lobed cotyledons displayed, much enlarged.

C.E. Faxon del.

Picart fr. sc.

TILIA AMERICANA. L.

A. Riocreux direx.t

Imp. R. Taneur. Paris.

C.E. Faxon del. Picart fr. sc.

TILIA AMERICANA, L.

A. Riocreux direx.t Imp. R. Taneur, Paris.

TILIA PUBESCENS.

Linden. Basswood.

YOUNG shoots and lower surface of the leaves covered with rufous pubescence. Pedunculate bract usually rounded at the base. Fruit globular.

Tilia pubescens, Aiton, *Hort. Kew.* ii. 229. — Willdenow, *Spec.* ii. 1162. — Ventenat, *Mém. Acad. Sci.* iv. 10, t. 3. — *Nouveau Duhamel*, i. 228. — Persoon, *Syn.* ii. 66. — Desfontaines, *Hist. Arb.* ii. 37. — Michaux f. *Hist. Arb. Am.* iii. 317, t. 3. — Pursh, *Fl. Am. Sept.* ii. 363. — De Candolle, *Prodr.* i. 513. — Hayne, *Dendr. Fl.* 112. — Elliott, *Sk.* ii. 3. — Watson, *Dendr. Brit.* ii. t. 135. — Don, *Gen. Syst.* i. 553. — Dietrich, *Syn.* iii. 237. — Chapman, *Fl.* 59. — Curtis, *Rep. Geolog. Surv. N. Car.* 1860, iii. 79. — Bayer, *Verhandl. Bot. Verein, Wien*, xii. 56. — Koch, *Dendr.* i. 479. — Gray, *Proc. Am. Acad.* n. ser. xxii. 305. — Watson & Coulter, *Gray's Man.* ed. 6, 101.

T. Americana, Walter, *Fl. Car.* 153 (not Linnæus).

T. laxiflora, Michaux, *Fl. Bor.-Am.* i. 306. — Poiret, *Lam. Dict.* vii. 683. — Persoon, *Syn.* ii. 66. — Pursh, *Fl. Am. Sept.* ii. 363. — Elliott, *Sk.* ii. 2. — De Candolle, *Prodr.* i. 513. — Hayne, *Dendr. Fl.* 113. — Dietrich, *Syn.* iii. 237. — Don, *Gen. Syst.* i. 553. — Spach, *Ann. Sci. Nat.* 2 ser. ii. 343, t. 15; *Hist. Veg.* iv. 32.

T. grata, Salisbury, *Prodr.* 367.

T. truncata, Spach, *Ann. Sci. Nat.* 2 ser. ii. 342; *Hist. Veg.* iv. 30. — Dietrich, *Syn.* iii. 237.

T. Americana, var. pubescens, Loudon, *Arb. Brit.* i. 374, t. — Gray, *Man.* ed. 5, 103; *Hall Pl. Texas*, 5. — Sargent, *Forest Trees N. Am.* 10*th Census U. S.* ix. 27.

T. Americana, var. Walteri, Wood, *Cl. Book*, 272; *Bot. & Fl.* 64.

A small tree, thirty or forty feet in height, with a trunk rarely exceeding twelve or fifteen inches in diameter. The bark of the trunk is a half to two thirds of an inch thick, furrowed, and divided into numerous parallel ridges, the reddish brown surface broken into numerous short thick scales. The bark of the branches, densely covered with pubescence during their first season, is puberulous during the second, and does not become glabrous until the third year, when it is red-brown, rugose, and marked with occasional small wart-like excrescences. The winter-buds are flattened, acuminate, dark reddish brown, and covered with short fine pubescence. The leaves are obliquely truncate at the base, rather remotely glandular-serrate, pubescent when they first unfold, especially on the lower surface, petioles and stipules, the upper surface becoming quite glabrous, and the lower surface nearly so at maturity. They are thin, membranaceous, and vary in length from two or three inches to four or five, and are borne on long stout or sometimes exceedingly slender petioles. The pedunculate bract is three or four inches long, usually sessile or very short-stalked, rounded at the two extremities, the midrib, as well as the peduncle and flower-buds, covered with pubescence. The flowers are smaller than those of *Tilia Americana*, with shorter and narrower calyx-lobes and narrow petals. They open in South Carolina late in May and during the first days of June. The ovary is covered with dense white tomentum which is pale brown when the fruit is full grown.

The northern station of *Tilia pubescens* is on Long Island, where this tree has been found in a swamp in Wading River, Suffolk County.[1] It grows on the coast of North and South Carolina and Georgia, in northern Florida, Louisiana, and occasionally in Texas, where it has been seen as far west as the Rio Blanco.[2]

Tilia pubescens is nowhere a common tree. On the coast of South Carolina and Georgia, where it appears more frequently perhaps than in other parts of the country, it is usually found growing on the

[1] E. S. Miller, in *Herb. Gray.*

[2] By N. J. Reverchon in 1885 near the town of Blanco. The distribution of *Tilia pubescens* is not yet satisfactorily determined. It will probably be found growing along the Atlantic seaboard at several points between its isolated northern station and North Carolina, and any Linden approaching the coast of southern New Jersey, or southward, might be this species, which will no doubt be found, too, on the Gulf coast of Alabama and Mississippi.

low bluffs of the sea islands in rich loam mixed with oyster-shells, the remains of Indian settlements or feeding-places, or along the banks of tide-water streams in rich sandy humid soil. It grows here with the Live Oak, the Hickories, the Palmetto, and the Carolina Cherry or Mock Orange; never, however, in sufficient numbers or of sufficient size to possess any commercial importance.

The wood of *Tilia pubescens* does not differ in appearance from that of *Tilia Americana*. The specific gravity of the absolutely dry wood of a tree from Bainbridge, Georgia, is 0.4074, a cubic foot of the dry wood weighing 25.39 pounds.

Tilia pubescens was, according to Aiton,[1] who first distinguished the species, introduced into England by Mark Catesby about 1726. The variety *leptophylla*, with larger and thinner leaves, was established by Ventenat on the Louisiana tree.[2]

[1] *Hort. Kew.* ii. 229.

[2] *Foliis basi oblique truncatis, laxe serratis, tenuissimis, subpapyraceis, subtus pubescentibus, Mém. Acad. Sci.* iv. 11. — Pursh, *Fl. Am. Sept.* ii. 363. — Gray, *Proc. Am. Acad.* n. ser. xxii. 305.

EXPLANATION OF THE PLATE.

Plate XXVI. Tilia Pubescens.

1. A flowering branch.
2. A group of stamens, with their petaloid scale, enlarged.
3. A pistil, enlarged.
4. A cluster of fruit.
5. Cross section of a fruit, enlarged.

C.E. Faxon del. Picart fr. sc.

TILIA PUBESCENS, Ait.

A. Riocreux direx.t Imp. R. Taneur, Paris.

TILIA HETEROPHYLLA.

Linden. Bee Tree.

LEAVES pale on the lower surface. Pedunculate bract tapering to a short-stalked or sessile base. Fruit globose.

Tilia heterophylla, Ventenat, *Mém. Acad. Sci.* iv. 16, t. 5. — *Nouveau Duhamel*, i. 229. — Poiret, *Lam. Dict.* vii. 683. — Pursh, *Fl. Am. Sept.* ii. 363. — Nuttall, *Gen.* ii. 3; *Sylva*, i. 90, t. 23. — De Candolle, *Prodr.* i. 513. — Dietrich, *Syn.* iii. 237. — Don, *Gen. Syst.* i. 553. — Spach, *Ann. Sci. Nat.* ser. 2, ii. 345; *Hist. Veg.* iv. 34. — Torrey & Gray, *Fl. N. Am.* i. 239. — Chapman, *Fl.* 60. — Curtis, *Rep. Geolog. Surv. N. Car.* 1860, iii. 79. — Bayer, *Verhandl. Bot. Verein, Wien*, xii. 51. — Ridgway, *Proc. U. S. Nat. Mus.* 1882, 61. — Sargent, *Forest Trees N. Am.* 10*th Census U. S.* ix. 27. — Gray, *Proc. Am. Acad.* n. ser. xxii. 305. — Watson & Coulter, *Gray's Man.* ed. 6, 101.

T. alba, Michaux f. *Hist. Arb. Am.* iii. 315, t. 2 (not Aiton). — Eaton & Wright, *Bot.* 452. — Darby, *Bot. S. States*, 262.

T. Americana, var. **heterophylla**, Loudon, *Arb. Brit.* i. 375, t.

T. heterophylla, var. **alba**, Wood, *Cl. Book*, 272; *Bot. & Fl.* 64.

T. heterophylla-nigra, Bayer, *Verhandl. Bot. Verein, Wien*, xii. 52.

A tree, fifty to sixty feet in height, with a trunk three or four feet in diameter, and slender branches which form generally a narrow rather pyramidal head. The bark of the trunk is half an inch thick, furrowed, the surface broken into short thin light brown scales. The bark of the branchlets is glabrous, green, or, when they have grown fully exposed to the sun, bright red, gradually turning brown during their second year, and plainly marked with many large oblong wart-like excrescences. The stout broadly ovate flattened winter-buds are bright red, covered with a slight glaucous bloom. The leaves are obliquely truncate or cordate at the base, the apex usually contracted into a short point, serrate with rather remote short glandular teeth. They are membranaceous, six or seven inches long, four or five inches broad, and are borne on long slender petioles; they are bright green and glabrous on the upper, pale or often silvery white on the lower surface, which is covered with short fine pubescence. The pedunculate bract is four or five inches long, obovate, generally less than an inch broad, rounded at the apex, and gradually narrowed into a sessile or short-stalked base. The flowers appear early in June, or, on the mountains of Tennessee and Carolina, late in June or early in July. They are larger than those of the other American species, with narrow calyx-lobes, pubescent on the inner, and puberulent on the outer surface, and narrow petals rather shorter than the long style. The ovary is covered with dense white tomentum, and the fruit is pubescent with short closely appressed cinereous hairs.

The northern limit of *Tilia heterophylla* is in the mountains of Pennsylvania; it extends southward through the Alleghany-mountain region to northern Alabama and to western and central Florida,[1] and westward to middle Tennessee and Kentucky and southern Indiana and Illinois. It is common on the slopes of the high mountains of the southern states, reaching its best development on those of eastern Tennessee.

Tilia heterophylla is found on rich wooded slopes in rather humid soil, or near the banks of streams, often growing in limestone soil. The trees with which it is often associated are the Tulip Poplar, the Yellow Buckeye, the White Ash, the Sorrel-tree, the White Birch, the Mountain Magnolia, the Hemlock, the Great Rhododendron, and the Chestnut and Red Oaks.

The wood of *Tilia heterophylla* resembles that of the other American Lindens. The sapwood is much thinner, however, being reduced sometimes to five or six layers of annual growth with a thickness of only half an inch. The specific gravity of the absolutely dry wood is 0.4253, a cubic foot of the

[1] Lake Charm, Orange County, Theodore L. Meade.

dry wood weighing 26.51 pounds. It is confounded commercially with the wood of *Tilia Americana*, and is used for the same purposes.

Tilia heterophylla was first distinguished by the French botanist Ventenat,[1] whose monograph of the genus Tilia was published in 1802. It had been previously introduced into European gardens by the elder Michaux[2] and by Fraser, although the fact that two species of Tilia were growing in the Alleghany Mountains seems to have escaped their notice, as well as that of the other botanists who visited that part of the country before the beginning of the present century.

Tilia heterophylla probably soon disappeared from gardens; and in cultivation it is still one of the rarest of the trees which inhabit the cooler parts of North America. Few North American trees, however, surpass it in beauty of foliage; and the contrast made by the silvery whiteness of the under surface of its ample leaves, as they flutter on their slender stems, with the dark green of the Hemlocks and Laurels on the banks of rapid mountain streams, produces one of the most beautiful effects which can be seen in the splendid forests which clothe the valleys of the southern Appalachian Mountains.

[1] Etienne Pierre Ventenat (1757–1808); a distinguished French botanist, author of several important works, the best known being his *Description des Plantes Nouvelles ou peu Connues, Cultivées dans le Jardin de J. M. Cels*, published in Paris in 1800, and the sumptuous *Jardin de la Malmaison*, published in Paris in 1803–4, under the auspices of the Empress Josephine.

[2] André Michaux (1746–1802); a French botanist who resided in America from 1785 to 1796, for the purpose of studying for the French government the plants and natural resources of the country. Michaux traveled extensively in the region east of the Mississippi River, from Hudson's Bay to Florida, and discovered many plants afterwards described by A. Richard in the *Flora Boreali-Americana*, published in Paris in 1803. Michaux's name as author appears on the title-page of this classical work, which was not published until after his death, and upon that of the *Histoire des Chênes de l'Amérique*, published in 1801, after Michaux had left France for Madagascar, where he died of fever. The journal of his travels in America, presented by his son, F. A. Michaux, to the American Philosophical Society, was published in 1889 in volume xxvi. of the Proceedings of that society.

EXPLANATION OF THE PLATE.

PLATE XXVII. TILIA HETEROPHYLLA.

1. A cluster of flowers, with its pedunculate bract.
2. Vertical section of a flower, enlarged.
3. A fruiting branch.
4. Cross section of a fruit, with two seeds developed, enlarged.
5. A seed, enlarged.
6. Vertical section of a seed, enlarged.

C. E. Faxon del.

Picart fr. sc.

TILIA HETEROPHYLLA, Vent.

A. Riocreux direx.t

Imp. R. Taneur. Paris.

GUAIACUM.

FLOWERS perfect, terminal, solitary or umbellate-fascicled; calyx 5 or rarely 4-lobed, imbricated in æstivation, deciduous; petals as many as the lobes of the calyx, imbricated in æstivation, hypogynous; stamens hypogynous, the filaments naked or squamate. Fruit fleshy, 2 to 5-celled, dehiscent; albumen corneo-cartilaginous, rimose. Leaves abruptly pinnate.

Guaiacum, Linnæus, *Gen.* 140. — A. L. de Jussieu, *Gen.* 296. — Adanson, *Fam. Pl.* ii. 507. — Endlicher, *Gen.* 1164. — Meisner, *Gen.* 59. — Gray, *Gen. Ill.* ii. 121; *Proc. Am. Acad.* n. ser. xxii. 306. — Bentham & Hooker, *Gen.* i. 267. — Baillon, *Hist. Pl.* iv. 608.

Porlieria, Ruiz & Pavon, *Prodr.* 55, t. 9. — Meisner, *Gen.* 59. — Endlicher, *Gen.* 1164. — Bentham & Hooker, *Gen.* i. 268.

Trees or shrubs, with white scaly bark, stout terete alternate branches often with swollen nodes, and hard resinous wood. Leaves petiolate, opposite, abruptly pinnate, with two to fourteen entire reticulate-veined leaflets, and minute more or less deciduous stipules. Flowers pedunculate from the axils of minute deciduous bracts, blue or purple. Sepals slightly united at the base, unequal. Petals broadly obovate, more or less unguiculate. Stamens ten, inserted on the short inconspicuous or elevated disk opposite to and alternate with the petals; filaments filiform, naked or bearing at the base on the inner surface a minute membranaceous scale; anthers oblong, fixed near the base, introrse, two-celled, the cells opening longitudinally. Pistil of two or five united carpels; ovary raised on a short thick stalk, obovate or clavate, two to five-lobed and two to five-celled, contracted into a slender subulate acute style; stigma minutely two to five-toothed or entire; ovules eight to ten in each cell, suspended in pairs from its inner angle by a slender funiculus, anatropous; the raphe ventral. Fruit smooth, coriaceous, narrowed at the base into a short stem, with two to five wing-like angles, ventrally and sometimes dorsally dehiscent. Seeds solitary or sometimes in pairs in each cell, suspended, ovoid; testa thick and fleshy, easily separating from the hard bony nucleus closely invested with a thin indistinct tegmen. Embryo straight or nearly so; cotyledons oval, foliaceous, incumbent or sometimes accumbent to the axis of the fruit; radicle short, superior.[1]

The genus Guaiacum, extended to include Porlieria, is found in the West Indies, in the countries adjacent to the Caribbean Sea and the gulfs of Mexico and California, and in the Andes of Peru. Botanists have distinguished about eight species, although further explorations in southern Mexico and in Central America, where seem to be the headquarters of the genus, may be expected to increase the number. The two[2] species first known occur in the West Indies. One of these reaches the South American continent, and the other the keys of southern Florida and the Bahama Islands, the most northern stations of the genus. One species[3] is found in western Texas and the adjacent regions of Mexico,

[1] Asa Gray has pointed out (*Pl. Wright.* i. 28. — *Smithsonian Contrib.* iii.) that the position of the cotyledons of *Porlieria hygrometrica*, Ruiz & Pavon, is not uniform, that they are occasionally incumbent in *Guaiacum officinale*, L. (*Proc. Am. Acad.* n. ser. xxii. 306), and that the squamiferous filaments depended on to separate Porlieria from Guaiacum are sometimes found in both genera, while the flowers of *Guaiacum parviflorum* are sometimes tetramerous as well as pentamerous. Baillon (*Adansonia*, x. 315) reached earlier the same conclusion, and united Porlieria to Guaiacum.

[2] *Guaiacum officinale*, Linnæus, *Spec.* 381, *Guaiacum sanctum*, Linnæus, *Spec.* 382.

[3] *Guaiacum angustifolium*, Engelmann, *Wislizenus Memoir of a Tour in Northern Mexico* (*Senate Doc.* 1848), Bot. Appx. 113. — Gray, *Gen. Ill.* ii. 123, t. 149.

where it is common on the dry gravelly mesas of the valley of the lower Rio Grande. A second North American species[1] is common in Sonora, and at least three little known species are found in southern Mexico and in Gautemala. One species[2] is widely distributed through the northern countries of South America from Cartagena to Venezuela, and a second South American species inhabits the Andes of Peru.[3] *Guaiacum officinale*, *Guaiacum sanctum*, and *Guaiacum arboreum* are small trees. The other species which with *Guaiacum arboreum* form the section *Porlieria* or *Guaiacidium*[4] are distinguished by their usually squamulose filaments, and are all low shrubs.

Heavy dense close-grained resinous wood is peculiar to all the species of the genus. The cells of the heartwood are filled with dark-colored resin, which gives it a dark greenish or yellow-brown color, while the sapwood, which is not resinous, is clear yellow. The Lignum-vitæ and the Guaiacum resin[5] of commerce are produced principally by the two West Indian species, *G. officinale* and *G. sanctum*.[6] The wood of these two trees, which is not distinguishable, owes its great strength to the peculiar intricate arrangement of the wood-fibre.[7] The medullary rays, which are numerous and equidistant, are not visible to the naked eye, and the layers of annual growth are hardly distinguishable, although the numerous circles formed by alternate darker and lighter bands which appear in the wood of these trees are sometimes mistaken for them. Lignum-vitæ is largely used for the sheaves of ship-blocks, for mallets, skittle-balls, and ten-pin balls, and for similar purposes.

Guaiacum wood enjoyed for centuries after the discovery of America a reputation as a remedy for syphilis;[8] it is now, however, only retained in the materia medica as an ingredient in the compound decoction of sarsaparilla. The resin is a stimulating diaphoretic and alterative, and is sometimes employed in the treatment of gout and rheumatism.[9]

Guaiacum, owing to its reported medicinal virtues, was one of the first plants of the New World to attract the attention of Europeans. Oviedo y Valdes, who landed in America in 1514, describes the tree under the aboriginal name of Guayacan, the Palo Sancto of the early colonists.[10] This was the *G. officinale;* Oviedo knew, however, of the existence of a second species which he found on the island of Porto Rico or Sanct Johan, where it was known also as Palo Sancto, the name which Linnæus has preserved for it. Oviedo's first work on the Natural History of America was published in 1526. Guaiacum, however, was known in Europe some years earlier. The stories of its medical virtues, told by the natives of San Domingo, were soon repeated in Spain and attracted the attention of European physicians. One Gonsalvo Ferrand has the reputation of having carried it to Europe about 1508;[11] and three works describing its virtues were published in Germany previous to 1520.[12]

[1] *Guaiacum Coulteri*, Gray, *Pl. Nov. Thurb.* 312 (*Mem. Am. Acad.* n. ser. v.).

[2] *Guaiacum arboreum*, De Candolle, *Prodr.* i. 707. — Guibourt, *Hist. Drog.* ed. 7, iii. 553 (*Zygophyllum arboreum*, Jacquin, *Pl. Amer.* 130, t. 80).

[3] *Guaiacum hygrometricum*, Baillon, *Adansonia*, x. 315 (*Porlieria hygrometrica*, Ruiz & Pavon, *Syst.* 94. — Guibourt, *Hist. Drog.* ed. 7, iii. 553), the type of the genus Porlieria.

[4] Gray, *Gen. Ill.* ii. 121.

[5] In the island of San Domingo, where Guaiacum resin is chiefly produced, it is collected from the trunks of the trees in part as a natural exudation, and sometimes from incisions made in the bark. It is obtained also by heating chips of the wood, or by setting fire to the ends of logs supported in a horizontal position above the ground on upright bars, a large incision having been made previously in the middle of the trunk; the resin, liquefied by the heat, flows from the cut in the trunk in considerable abundance. (Flückiger & Hanbury, *Pharmacographia*, 95.)

[6] The wood of *Guaiacum angustifolium* is locally employed in medicine in the same manner as that of the West Indian trees, Wislizenus, *Memoir of a Tour in Northern Mexico* (*Senate Doc.* 1848), Bot. Appx. 113; and the wood of *G. arboreum* is said to be sometimes exported in small quantities from the United States of Colombia.

[7] Browne, *Nat. Hist. Jam.* 226. — Lindley, *Nat. Syst. Bot.* ed. 2, 134.

[8] The treatment with Guaiacum consisted in confining the patient in a closed room heated to a high temperature, and in administering twice a day, for several days, copious doses of a milk-warm decoction prepared from the wood. It was generally recognized in the beginning of the present century that Guaiacum was powerless to eradicate the venereal poison. (*Mat. Med. Brit.* ed. 1807.)

[9] Berg, *Pharm. Anat. Atl.* 53, t. 27. — Flückiger & Hanbury, *Pharmacographia*, 96. — Guibourt, *Hist. Drog.* ed. 7, iii. 551.

[10] *Sumario*, cap. lxxv.; *Hist. Gen. Nat. Ind.* lib. 10, cap. 2.

[11] Jonathan Pereira, *Elements Mat. Med.* ed. 2, ii. 1653.

[12] *De cura Morbi Gallici per Lignum Guayacanum libellus*, printed in 1535, but dated December 19, 1517.

De morbo Gallico tractatus, Salisburgi, November, 1518.

Ulrichi de Hutten equitis de Guaiaci medicina et morbo Gallico liber

The generic name Guaiacum, derived from the West Indian *Guaiaco* or *Guayacan*, the aboriginal name of *G. officinale* and of *G. sanctum*, first used by Plumier,[1] was afterwards adopted by Linnæus.

unus, Morguntiæ, 1519. These tracts, which I have not seen, are quoted by Flückiger & Hanbury, *l. c.* Two early tracts, published in German, and believed to have been translated from the Spanish, are contained in the John Carter Brown Library at Providence. The first of these, published in 1524, is entitled *Ayn Recept von ainem, holtz zü brauchē für die kranckhait der franczosen vnd ander flüssig offen schäden, ausz Hispanyscher sprach zü teutsch gemacht, darzü dz. Regement wie man sich darin halten vñ auch darzü schicken soll.* (Colophon:) *Gedruckt vñ volendt in der Kaiserlichē Stat Augspurg, an dē achtenden tag des Aprillen, des jars nach der geburt Christi vnsers herren, Tausent fünff hundert vnd im. xxiiii. Jare.* The second, without date, but believed to have been printed about the same time, is entitled *Eyn Bewert Recept, wie man das holtz Guayacā für die kranckheyt der Frantzosen brauchen sol.*

[1] *Nov. Gen. Pl. Am.* 39, t. 17.

GUAIACUM SANCTUM.

Lignum-vitæ.

FLOWERS solitary; filaments naked. Fruit 5-celled, 5-angled; cotyledons accumbent to the axis of fruit. Leaves composed of several pairs of leaflets.

Guaiacum sanctum, Linnæus, *Spec.* 382. — De Candolle, *Prodr.* i. 707. — Nuttall, *Sylva*, iii. 16, t. 86. — Gray, *Gen. Ill.* ii. 123, t. 148. — Schnizlein, *Icon.* t. 253, f. 21. — Grisebach, *Fl. Brit. W. Ind.* 134. — Chapman, *Fl.* 64. — Sargent, *Forest Trees N. Am.* 10*th Census U. S.* ix. 28.

G. verticale, Ortega, *Dec.* viii. 93. — De Candolle, *Prodr.* i. 707. — Richard, *Fl. Cub.* 321. — Hemsley, *Bot. Biol. Am. Cent.* i. 159.

G. sanctum, var. parvifolium, Nuttall, *Sylva*, iii. 17.

A low gnarled round-headed tree, growing sometimes to a height of twenty-five or thirty feet, with a short stout trunk occasionally two and a half to three feet in diameter, and slender pendulous branches. The bark of the trunk is rarely more than an eighth of an inch thick, the surface separating into small thin white scales resembling those covering the trunk of a vigorous White Oak. The branches are conspicuously enlarged at the nodes, slightly angled, and covered when they first appear with a short fine pubescence; this gradually disappears during their first season, and in the second year they are glabrous and covered with white slightly furrowed bark, roughened by numerous small excrescences. The leaves are three or four inches long, and are composed of three to five pairs of obliquely oblong or obovate mucronate sessile leaflets an inch long and nearly half an inch broad. The stipules are broadly acuminate, tipped with a short mucro, and covered with pubescence; they are an eighth of an inch long, usually caducous, but sometimes persistent during the season. The leaves remain on the branches until the appearance of the new growth, which, in Florida, is in March or early April. The young leaves when they first appear are pubescent, especially on the midrib and on the under surface of the thin membranaceous light green leaflets, which become glabrous at maturity and are then rather coriaceous and dark lustrous green on both surfaces. The flowers, which are two thirds of an inch across when expanded, appear almost immediately after the beginning of the annual growth, and continue to open during several weeks. They are borne on slender pubescent peduncles shorter than the leaves, and generally produced three or four together at the end of the branches from the axils of the upper pair of leaves. The three pedunculate bracts are acuminate, minute, the two lateral rather smaller than the outer one. The sepals are obovate, slightly pubescent, especially on the outer surface near the base, and smaller than the broadly obovate unguiculate petals which have a half twist from left to right near the base, giving them the appearance of being inserted obliquely. The ovary is obovate, prominently five-angled, glabrous, and contracted at the base into a short stout stalk. The fruit is broadly obovate, three fourths of an inch long, half an inch broad, and bright orange-colored. It opens at maturity by the splitting of the thick rather fleshy valves, disclosing the large seeds with their thick fleshy scarlet aril-like outer coating.

Guaiacum sanctum inhabits, in Florida, the southern keys from Key West eastward. It was formerly common on Key West, where a few old specimens with large hollowed trunks still exist; it abounds on Upper Metacombe and Lignum-vitæ Keys, and is less common on Lower Metacombe and Umbrella Keys. It grows also on the Bahama group, on San Domingo and Porto Rico, and perhaps on Barbadoes.[1] Its companions in the forests of the Florida keys are the Eugenias, the Gumbo Limbo,

[1] The only authority for Barbadoes as a station for this tree is Griffith Hughes' *History of the Barbadoes*, published in 1750. His description, on page 142, of "Lignum-vitæ or Guaiacum," might refer to either of the West Indian species; his figure, however, very well represents *G. sanctum*.

the Pisonias, the Citharexylum, the Florida Coccoloba, the Drypetes, the Bumelia, the Ardisia, and the Exostema.

The specific gravity of the absolutely dry wood of *Guaiacum sanctum* produced in Florida is 1.1432, a cubic foot of the dry wood weighing 71.24 pounds. The tree is not abundant enough within the limits of the United States to give the Florida-grown wood any commercial importance; on the Bahama Islands it is more common, and is the source of all the Lignum-vitæ which at different times has been exported in considerable quantities from those islands.

Guaiacum sanctum was first distinguished by Oviedo, and it was noticed and described by several of the early authors who wrote upon American plants.[1] The fact that it grew within the limits of the United States was first established by Dr. J. L. Blodgett.

The whiteness of the bark of this tree, its dark green lustrous foliage, and the graceful habit of its branches, make it a striking and attractive object at all seasons of the year; its beauty in the early spring, when the delicate new foliage is unfolding and the branches are covered with the bright blue flowers, is not surpassed by that of any of the plants which inhabit the Florida keys.

[1] *Del Guayacum y palo sancto*, Monardes, *Hist. Med.* fol. 12 (ed. Sevilla, 1574).

Guajacum, propemodum sine matrice, quibusdam lignum sanctum, Indis Hoaxacan & Matlalquauhitl, Jonston, *Dendrolographia*, 426.

Guajacum propemodum sine matrice, C. Bauhin, *Pin.* 448.

Guajacum Americanum alterum, fructu Euonymi, Breyne, *Prodr.* i. 24.

Guajacum foliis Lentisci, Breyne, *Prodr.* ii. 69.

Euonymo adfinis, Occidentalis, alatis Rusci foliis, Nucifera, cortice ad genicula, fungoso, Plukenet, *Alm. Bot.* 139, t. 94, f. 4.

Guaiacum flore cæruleo, fimbriato, fructu tetragono, Plumier, *Nov. Pl. Am. Gen.* 39.

Guajacum foliis pinnatis, foliolis obverse ovatis integerrimis, Royen, *Fl. Leyd. Prodr.* 268.

EXPLANATION OF THE PLATE.

Plate XXVIII. Guaiacum sanctum.

1. A flowering branch, natural size.
2. Diagram of a flower.
3. Vertical section of a flower, the pistil entire, enlarged
4. Anterior and posterior views of a stamen, enlarged.
5. Vertical section of a pistil, enlarged.
6. An ovule, much enlarged.
7. A fruiting branch, natural size.
8. Vertical section of a fruit, natural size.
9. A seed, the outer coating removed, natural size.
10. Vertical section of a seed, natural size.
11. An embryo, much enlarged.

C. E. Faxon del.

Picart fr. sc.

GUAIACUM SANCTUM, L.

A. Riocreux direx.t

Imp. R. Taneur, Paris.

XANTHOXYLUM.

FLOWERS diœcious or polygamous; calyx 3 to 5-lobed, hypogynous, imbricated in æstivation, rarely wanting; petals 3 to 5, hypogynous, imbricated or rarely induplicate-valvate in æstivation. Fruit composed of 1 to 5 coriaceous or fleshy 1-seeded carpels.

Xanthoxylum, Linnæus, *Gen.* ed. 6, 519. — A. L. de Jussieu, *Gen.* 374. — Endlicher, *Gen.* 1146. — Meisner, *Gen.* 64. — Gray, *Gen. Ill.* ii. 147. — Bentham & Hooker, *Gen.* 297. — Baillon, *Hist. Pl.* iv. 468.
Fagara, Adanson, *Fam. Pl.* ii. 364.
Pterota, Browne, *Nat. Hist. Jam.* 189.
Blackburnia, Forster, *Char. Gen.* t. 6.
Curtisia, Schreber, *Gen.* 199.
Ochroxylum, Schreber, *Gen.* 826.
Pseudopetalon, Rafinesque, *Fl. Ludovic.* 108.
Langsdorfia, Leandro, *Act. Monac.* 1819, 239 (ex. *Endlicher Gen.* 1147).
Tobinia, Desvaux, *Hamilton Prodr. Fl. Ind. Occ.* 56.
Pohlana, Nees & Martius, *Nov. Act. Nat. Cur.* ii. 185.

Trees or shrubs, with acrid aromatic bark and pellucid aromatic-punctate fruit and foliage, usually armed with stipular prickles. Leaves alternate, usually unequally pinnate, or rarely one to three foliolate, the petioles sometimes prickly, rarely winged; leaflets generally opposite, often oblique at the base, entire or crenulate. Flowers small, often unisexual, greenish white or white, produced in axillary or terminal, broad or contracted, pedunculate cymes. Disk small or obscure. Stamens as many as the petals and alternate with them, hypogynous; effete, rudimentary or wanting in the female flowers; filaments filiform or subulate; anthers introrse, two-celled, opening longitudinally. Pistils one to five, oblique, raised on the summit of a fleshy gynophore, connivent, sometimes slightly united below; rudimentary, simple or two to five-parted in the sterile flowers; ovary one-celled; styles short and slender, connivent or connate towards the summit; stigmas capitate; ovules two, collateral, pendulous from the inner angle of the cell, anatropous; the raphe ventral. Follicles of fruit as many as the pistils, or by abortion fewer, broadly obovate, sessile or stipitate, ventrally dehiscent. Seed oblong or globular, suspended on a slender funiculus, often hanging from the carpel at maturity; testa thin, bony or crustaceous, blue or black, shiny, conspicuously marked by the broad hilum; tegmen thick, crustaceous. Embryo axile, straight or arcuate; cotyledons oval or orbicular, foliaceous; radicle short, superior.

The genus Xanthoxylum is widely distributed through tropical and extra-tropical regions. Eighty to one hundred species are distinguished, of which a large part inhabit tropical America. The genus is represented in North America by five species; three attain the size of small trees, the others are tree-like shrubs.[1]

[1] *Xanthoxylum Americanum*, Miller, *Dict.* — *Xanthoxylum emarginatum*, Swartz, *Fl. Occ.* i. 572.

X. Americanum is common in the northern states from eastern Massachusetts to Minnesota, extending south to the mountains of Virginia, and to eastern Kansas. It is a spreading shrub, attaining sometimes in cultivation the habit of a small tree. The flowers, which are produced before the leaves in axillary clusters, are destitute of sepals. The bark, leaves, and fruit are exceedingly acrid and aromatic, and are a popular remedy for toothache.

X. emarginatum is a West Indian species with coriaceous shining leaves, composed of two or four pairs of entire leaflets, and a three-parted calyx. It is described as a shrub or small tree. The wood is said by Baillon (*Hist. Pl.* iv. 438) to be white, heavy, and aromatic, and to be one of the so-called rosewoods exported from the West Indies. It is described by Macfadyen (*Fl. Jam.* 191), who makes no mention of its economic properties, as a shrubby tree. This species was found by Dr. A. P. Garber, on an island in Bay Biscayne in 1877, growing as a small shrub. It has not since been seen in the United States, although the shores of Bay Biscayne have been several times carefully explored by botanists.

Abraham Pascal Garber (1838–1881), who found this plant in Florida, was a native of Columbia, Pennsylvania, a graduate of La Fayette College, where he acquired a taste for botany, and of the medical school of the University of Pennsylvania. Dr. Garber

Numerous species occur in the West Indies,[1] in Mexico and Central America,[2] in Brazil[3] where nearly fifty species are recognized, and in the other countries of tropical America. The genus has several representatives in tropical Africa,[4] in India,[5] China,[6] and Japan,[7] in the Malay Archipelago, and in Australia, where three species occur.[8]

The bark of Xanthoxylum, especially that of the roots, contains a bitter principle,[9] which has been found identical with Berberina,[10] an acrid resin, and a yellow coloring matter. It is a powerful stimulant and tonic, sometimes used in the treatment of rheumatism, to excite salivation and to alleviate toothache. The bark of several West Indian species is considered anti-syphilitic. The roots of *Xanthoxylum nitidum* are deemed sudorific in China, and are thought to furnish a valuable febrifuge. The fruit of *Xanthoxylum elatum* is used in India as a condiment, and the seeds to poison fish;[11] and the leaves and fruit of this species are used by the Chinese as a stimulant, sudorific, and anthelmintic; and silkworms are fed upon the leaves.[12] The capsules of *X. piperitum* furnish the Japanese pepper of commerce, and are used medicinally in China.[13] The wood of *X. brachyacanthum* of Australia is used in cabinet-making,[14] and the wood of some of the West-Indian species is considered valuable.

Xanthoxylum,[15] derived from *ξανθός* and *ξύλον*, appears to have been first used as the name of a plant by Plukenet,[16] who applied it to a West Indian tree. The name was afterwards used by Catesby, and adopted by Linnæus, who credited the genus to Cadwallader Colden[17] who had published a description of the northern Prickly Ash with generic characters.[18]

practiced his profession for a short time in Pittsburgh, but was forced by ill-health to seek a milder climate. He passed four winters in southern Florida, where he discovered many new species of plants (*Eugenia Garberi, Liatris Garberi, Habenaria Garberi*, etc.), and determined the presence in Florida of several West Indian trees. Dr. Garber made a botanical excursion to Porto Rico in 1880. *Garberia* of a single species — a Florida shrub with Liatris-like flowers — commemorates Dr. Garber's services to American botany.

[1] Grisebach, *Fl. Brit. W. Ind.* 136.

[2] Hemsley, *Bot. Biol. Am. Cent.* i. 168.

[3] Eichler, *Martius Fl. Brasil.* xii. 2, 151.

[4] Oliver, *Fl. Trop. Afr.* i. 304. — Baker, *Fl. Maur. & Seych.* 39.

[5] Hooker f. *Fl. Brit. Ind.* i. 492.

[6] Forbes & Hemsley, *Jour. Linn. Soc.* xxiii. 105.

[7] Franchet & Savatier, *Enum. Pl. Jap.* i. 72.

[8] Bentham, *Fl. Austral.* i. 362.

[9] *Xanthopicrite*, Chevallier & Pelletan, *Ann. Chem. Phy.* ser. 2, xxxiv. 200.

[10] Dyson-Perrins, *Pharm. Jour.* ser. 2, iv. 403.

[11] Brandis, *Forest Flor. Brit. Ind.* 47.

[12] Smith, *Contrib. Mat. Med. China*, 234.

[13] Smith, *l. c.*

[14] Maiden, *Useful Native Plants of Australia*, 615.

[15] The word was written *Zanthoxylum* by Plukenet and Linnæus, and many authors have followed this faulty orthography. It was corrected, however, by Miller, whose spelling of the word has been adopted by several prominent botanists, including Asa Gray (*Proc. Am. Acad.* n. ser. xxiii. 225).

[16] *Alm. Bot.* 396, t. 239, f. 3.

[17] Cadwallader Colden (1688–1776); a native of Dunse, Scotland, graduated at the medical school of Edinburgh in 1775. Dr. Colden practiced his profession in Pennsylvania from 1708 to 1715, and in 1719 received the appointment of surveyor-general of New York, and that of lieutenant-governor of the province in 1761, performing the duties of governor for much of the time until 1775, when he retired to Long Island, where he died in his eighty-ninth year. Dr. Colden was one of the most distinguished of the early cultivators of science in America. He became interested in botany through the publications of Linnæus, with whom, and with other European men of science, he carried on an active correspondence during many years. His paper on the *Plantæ Coldenhamiæ*, published in the Transactions of the Royal Society of Science at Upsala, in 1742, is the earliest contribution to a knowledge of the botany of the State of New York. It was considered an extraordinary performance, and received the highest praise from Linnæus and Gronovius.

[18] *Pl. Colden.* 107.

CONSPECTUS OF THE NORTH AMERICAN SPECIES.

Inflorescence terminal.

Calyx lobes 5.

Leaves deciduous, stems armed . . . . . 1. X. CLAVA-HERCULIS.

Leaves persistent, stems unarmed . . . . . 2. X. CRIBROSUM.

Calyx lobes 3.

Leaves evergreen . . . . . 3. X. EMARGINATUM.

Inflorescence axillary.

Flowers complete . . . . . 4. X. FAGARA.

Flowers destitute of calyx . . . . . 5. X. AMERICANUM.

XANTHOXYLUM CLAVA-HERCULIS.

Prickly Ash. Toothache Tree.

FLOWERS in terminal clusters; sepals and petals 5. Leaves deciduous.

Xanthoxylum Clava-Herculis, Linnæus, *Spec.* 270 (excl. loc. nat. Jam.). — Bartram, *Trav.* 88. — Willdenow, *Spec.* iv. 754, in part. — Elliott, *Sk.* ii. 690. — Planchon & Triana, *Ann. Sci. Nat.* ser. 5, xiv. 317. — Sargent, *Forest Trees N. Am.* 10*th Census U. S.* ix. 30. — Watson & Coulter, *Gray's Man.* ed. 6, 107.

X. fraxinifolium, Walter, *Fl. Car.* 243 (not Marshall).

Fagara fraxinifolia, Lamarck, *Ill.* t. 334.

X. Carolinianum, Lamarck, *Dict.* ii. 39; *Ill.* 403, t. 811, f. 1. — Gærtner, *Fruct.* i. 333, t. 68, f. 8. — Torrey & Gray, *Fl. N. Am.* i. 214. — Gray, *Gen. Ill.* ii. 148, t. 156, f. 13, 14. — Scheele, *Roemer Texas*, 432. — Nuttall, *Sylva*, iii. 8, t. 83. — Chapman, *Fl.* 66. — Curtis, *Rep. Geolog. Surv. N. Car.* 1860, iii. 103.

X. aromaticum, Willdenow, *Spec.* iv. 755 (excl. syn.). — Jacquin f. *Eclog.* i. 103, t. 70.

X. tricarpum, Michaux, *Fl. Bor.-Am.* ii. 235. — Poiret, *Lam. Dict.* Suppl. ii. 294. — Aiton, *Hort. Kew.* ed. 2, v. 383. — Pursh, *Fl. Am. Sept.* i. 210. — De Candolle, *Prodr.* i. 726. — Elliott, *Sk.* ii. 690. — A. de Jussieu, *Mém. Mus.* xii. t. 25, f. 38. — Sprengel, *Syst.* i. 945. — Don, *Gen. Syst.* i. 803. — Spach, *Hist. Veg.* ii. 365. — Loudon, *Arb. Brit.* i. 488. — Dietrich, *Syn.* ii. 1000.

Kampmania fraxinifolia, Rafinesque, *Med. Rep.* v. 352.

Pseudopetalon glandulosum, Rafinesque, *Fl. Ludovic.* 108; *Med. Bot.* ii. 114.

Pseudopetalon tricarpum, Rafinesque, *Med. Bot.* ii. 114.

X. Catesbianum, Rafinesque, *Med. Bot.* ii. 114.

A round-headed tree, twenty-five or thirty, or exceptionally fifty feet in height, with a short trunk twelve to eighteen inches in diameter, and numerous branches spreading nearly at right angles; or often a low shrub. The bark of the trunk of fully grown trees is barely a sixteenth of an inch thick, light gray, and studded with corky tubercles with ovoid dilated bases sometimes an inch or more across, and thick and rounded at the apex. The bark of the branches is covered, when they first appear, with brown pubescence, and is glabrous and light gray the second season. It is marked with small glandular spots and armed with stout straight, or sometimes slightly curved, sharp chestnut-brown prickles, half an inch or more long, with perpendicularly flattened, enlarged bases. The winter-buds are short, obtuse, and dark brown or nearly black. The leaves, which remain upon the branches until late in the winter, or until the tree begins to grow in early spring, are five to eight inches long, and are composed of three to eight pair of leaflets borne on stout pubescent or glabrous armed leaf-stalks terminated by single leaflets. The leaflets are ovate or ovate-lanceolate, sometimes slightly falcate, usually oblique at the base, crenately serrate, sessile or short-stalked. They are an inch to two and a half inches long, green and lustrous on the upper surface, paler and often somewhat pubescent below, especially when they first unfold. The sterile and fertile flowers are borne on different trees. The inflorescence, which is an ample wide-branched cyme four or five inches long and two or three inches broad, that of the fertile tree being somewhat contracted, appears when the leaves of the year are about half grown. The flowers are borne on slender pedicels a third to a quarter of an inch long, with a minute lanceolate deciduous bract at their base. The sepals are minute, membranaceous, persistent, barely a quarter of the length of the oval greenish white petals which vary from an eighth to a quarter of an inch in length. The five stamens with slender filiform filaments are conspicuously exserted from the male flowers, and are rudimentary or wanting in the female flowers. There are two, or most frequently three, pistils with sessile ovaries, and short styles crowned by a slightly two-lobed stigma. The fruit is borne in dense often nearly globose clusters and ripens in August and September. The ripe carpels are obliquely ovoid, one-seeded, chestnut-brown, a quarter of an inch long, with a rugose or pitted surface. The seeds are black and lustrous, and hang at maturity outside the carpels.

Xanthoxylum Clava-Herculis grows from the southern part of the State of Virginia southward

near the coast to the shores of Bay Biscayne and Tampa Bay, Florida; it extends westward through the Gulf states to northwestern Louisiana and southern Arkansas, and through Texas to the valley of the Devil's River, in the western part of the state. It is nowhere common in the Atlantic states, where it is confined to the immediate neighborhood of the coast, growing in light sandy soil, often on the low bluffs of islands or river banks, or occasionally in abandoned fields. Its associates here are the Live Oak, the Water Oak, the Loblolly Pine, the Red Bay, and the Dwarf Palmetto. It extends farther from the coast in the Gulf states, especially west of the Mississippi River, and it is not unusual to find it in southern and central Alabama and Mississippi, growing along the margins of swamps, in rich sandy soil with Pines, Live Oaks, the Florida Illicium, the Styrax, the Symplocos, the Holly, and the Nyssa. It is very common in eastern Texas, attaining its largest size on the rich intervale lands of the streams flowing into the Trinity River. Farther west it is greatly reduced in size and of rare occurrence.

The wood of *Xanthoxylum Clava-Herculis* is light, soft, and close-grained, with numerous thin medullary rays; it is light brown, with yellow sapwood, and has, when absolutely dry, a specific gravity of 0.5056, a cubic foot of the dry wood weighing 31.51 pounds.

The bark of *Xanthoxylum Clava-Herculis* contains the active properties found in that of the other species of the genus, and, as well as the leaves and fruit, is used for the same purposes.[1] The bark is held in high esteem by the negroes, who collect it in large quantities, and are fast exterminating the tree, especially along the Atlantic seaboard.

The earliest account of *Xanthoxylum Clava-Herculis* seems to have been that of Ray,[2] published in 1668. It was known to Plukenet,[3] and described by Catesby in his *Natural History of Carolina*.[4] It appears to have been introduced into England at least as early as the beginning of the eighteenth century,[5] and was cultivated in 1739 by Philip Miller at Chelsea.[6]

There is a form[7] of this tree in southern Florida and in western Texas with short, sometimes three-foliate,[8] more or less pubescent leaves with small ovate or oblong blunt and conspicuously crenulate rather coriaceous leaflets. This is the common form of west Texas, where it grows usually as a low shrub, attaining sometimes in the region immediately adjacent to the coast the size and habit of a small tree.

[1] "It is used to cure the Tooth-ache, by putting a Piece of the Bark in the Mouth, which being very hot, draws a Rhume from the mouth, and causes much Spittle." (Lawson, *The History of Carolina*, 100.)

B. S. Barton, *Coll.* i. 26, 54; ii. 38.

U. S. Nat. Disp. ed. 2, 1535.

[2] *Arbor spinosa Virginiana, caudice & ramis Lanigeræ spinosæ Malabaricæ similis; an Herculis clava Mus. Societ. Regiæ? Hist. Pl.* ii. 1800.

[3] *Arbor aculeata, Caroliniana, spinis grandioribus, crebris tuberculis innascentibus; cortice urens, Alm. Bot.* 43.

Euonymo adfinis aromatica, s. Zanthoxylum Floridanum, Fraxini foliis, minus spinosum, Amalth. Bot. 76.

[4] *Zanthoxylum spinosum, Lentisci longioribus foliis Euonymi fructu capsulari ex insula Jamaicensi*, i. 26, t. 26. — Royen, *Fl. Lugd. Prodr.* 535.

Zanthoxylum, Linnæus, *Hort. Cliff.* 487 (excl. syn. Plukenet). The name of *Clava-Herculis* appears to have been first used by Trew to describe the spiney trunk of a Xanthoxylum from the southern part of North America in the museum of the Royal Society at London. This is the plant described by Linnæus as *Z. Clava-Herculis* in the *Species Plantarum*, as shown by his reference to Catesby's excellent figure. Misled, however, by Catesby's erroneous reference to Jamaica, Linnæus supposed that the Carolina and Virginia plant was a native also of that island. The error was copied by Willdenow; Swartz and De Candolle suppressed the North American station entirely, describing a West Indian tree as *X. Clava-Herculis;* but that name being preoccupied for the Carolina plant, the West Indian species, as shown by Triana & Planchon (*Ann. Sci. Nat.* ser. 5, 14, 319), becomes *X. Caribæum* of Lamarck (*Dict.* ii. 110).

[5] "In Horto Industrii Hortulani D. Darby, apud Hoxtoniam, vicum Londoni nostri suburbanam, ex feminibus natum conspeximus," Plukenet, *Amalth. Bot.* 76.

[6] *Hort. Kew.* iii. 399.

[7] *Xanthoxylum Clava-Herculis*, var. *fruticosum*, Gray, *Pl. Wright.* i. 30 (*Smithsonian Contrib.* iii.); *Proc. Am. Acad.* n. ser. xxiii. 225. — Torrey & Gray, *Pacific R. R. Rep.* ii. 161. — Torrey, *Bot. Mex. Bound. Surv.* 43. — Chapman, *Fl.* 66.

X. hirsutum, Buckley, *Proc. Phil. Acad.* 1861, 450.

[8] Watson, *Proc. Am. Acad.* xvii. 335.

EXPLANATION OF THE PLATE.

PLATE XXIX. XANTHOXYLUM CLAVA-HERCULIS.

1. A staminate inflorescence, natural size.
2. A pistillate inflorescence, natural size.
3. A staminate flower, enlarged.
4. Vertical section of a staminate flower, enlarged.
5. A pistillate flower, enlarged.
6. Vertical section of a pistillate flower, enlarged.
7. A fruiting branch, natural size.
8. Vertical section of a fruit, enlarged.
9. Cross section of a fruit, enlarged.
10. An embryo, much enlarged.
11. Diagram of a staminate flower.
12. Diagram of a pistillate flower.
13. Portion of a young branch with prickles.

C. E. Faxon del.

Picart fr. sc.

XANTHOXYLUM CLAVA-HERCULIS, L.

A. Riocreux direx.t

Imp. R. Taneur, Paris.

XANTHOXYLUM CRIBROSUM.

Satinwood.

UNARMED. Flowers in terminal clusters; sepals and petals 5. Leaves persistent.

Xanthoxylum cribrosum, Sprengel, *Syst.* i. 946. — Dietrich, *Syn.* ii. 1001. — Sargent, *Garden and Forest*, ii. 616.

X. Floridanum, Nuttall, *Sylva*, iii. 14, t. 85. — Chapman, *Fl.* 66.

X. Caribæum, Watson, *Index*, 155 (not Lamarck). — Sargent, *Forest Trees N. Am. 10th Census U. S.* ix. 30.

X. Caribæum, var. Floridanum, Gray, *Proc. Am. Acad.* n. ser. xxiii. 225.

A small round-headed tree, thirty to thirty-five feet in height, with a trunk twelve to eighteen inches in diameter. The bark of the trunk is a quarter of an inch thick, with a smooth light gray surface divided by shallow furrows and broken into numerous short appressed scales. The branchlets, when they first appear, are densely coated with thick silky pubescence; they are stout, very brittle, puberulent during their second and third years, and covered with light gray rugose bark conspicuously marked with large triangular leaf-scars. The winter-buds are narrowly acuminate, half an inch long, and coated with short thick pale tomentum. The leaves, which appear in Florida during the month of June, are usually composed of four pairs and a terminal leaflet; they are sometimes three-foliolate, and are rarely reduced to a single leaflet. They vary usually from six to nine inches in length, although sometimes much shorter, and are borne on stout glandular petioles with enlarged bases. The leaves are densely covered with tomentum when they first unfold, and retain at maturity a few scattered hairs on the petioles and along the midribs of the leaflets. These are ovate-lanceolate, or elliptical and obtuse, often slightly falcate, regularly contracted into a stout petiole, or sometimes distinctly oblique at the base. They are nearly sessile or long-stalked, two to three inches long, an inch and a half to two inches broad, with entire or slightly crenulate margins, and are coriaceous, pale yellow-green, and conspicuously marked with large pellucid glands. The staminate and pistillate flowers are produced on separate plants, and are borne in wide-spreading pubescent sessile cymes, those of the female plant being usually divided at the base into three principal branches. The flowers appear in Florida in June soon after the trees begin their annual growth; they are borne on slender pubescent pedicels a quarter of an inch or more long, the basal bract covered with thick white tomentum. The minute acuminate calyx-lobes with ciliate margins are barely an eighth of the length of the ovate greenish white petals, which are reflexed when the flowers are fully expanded. The staminate flowers have five stamens with slender filaments much longer than the petals, and a minute depressed rudimentary ovary. The fertile flowers show no trace of stamens, and contain usually two, or sometimes a single pistil with a stipitate obovate ovary and a short style with a spreading entire stigma. The fruit ripens in autumn or early winter, and may sometimes be found attached to the branches late in the spring of the following year. The ripe carpels are obliquely obovate, short-stalked, one-seeded, pale chestnut-brown at maturity, a third of an inch long or less, the surface faintly marked with minute glands. The seeds are black and lustrous.

Xanthoxylum cribrosum now grows in Florida on the Marquesas Keys, and on South Bahia Honda and Boca Chica Keys.[1] It occurs in San Domingo,[2] Porto Rico,[3] the Bahama Islands,[4] and Bermuda.[5]

[1] There is reason to believe that this tree was formerly much more common on the Florida keys, where it is sought for its valuable wood. Dr. Blodgett, as quoted by Nuttall (*Sylva*, iii. 14), spoke of it as a large and common tree on Key West, from which it has now entirely disappeared.

[2] Sprengel, *l. c.*

[3] P. Sintenis, *Plantæ Portoricensis*, No. 3708, 1886, in *Herb. Kew.*

[4] Brice, No. 410, Eggers, No. 4497, in *Herb. Kew.*

[5] Lefroy, in *Herb. Kew.*

The wood of *Xanthoxylum cribrosum* is very heavy and exceedingly hard, although brittle and not strong; it possesses a clear firm grain and is easily worked, and the surface can be made to receive a beautiful polish; it contains numerous thin conspicuous medullary rays and is light orange-colored, the thin sapwood being rather lighter colored. The specific gravity of the absolutely dry wood is 0.9002, a cubic foot of the dry wood weighing 56.10 pounds. It has, when first cut, the odor of the true satinwood, a peculiarity which causes this tree to be called Satinwood by the inhabitants of the Florida keys, by whom it is used in the manufacture of various articles of furniture, the handles of tools, and other objects of domestic use.

Xanthoxylum cribrosum was discovered in San Domingo during the first quarter of the century,[1] and was detected in Florida by Dr. J. L. Blodgett.

[1] Specimens collected in San Domingo by Berterio, and communicated in 1824 by Professor Balbis of Turin, are preserved in the herbarium of the Berlin Botanic Garden, where there are also San Domingo specimens from Kunth's herbarium.

EXPLANATION OF THE PLATES.

PLATE XXX. XANTHOXYLUM CRIBROSUM.

1. A flowering branch of a staminate tree, natural size.
2. A flowering branch of a pistillate tree, natural size.
3. A flower-bud, enlarged.
4. A staminate flower, enlarged.
5. Vertical section of a staminate flower, enlarged.
6. A pistillate flower, enlarged.
7. Cross section of an ovary, enlarged.
8. Vertical section of an ovary, enlarged.

PLATE XXXI. XANTHOXYLUM CRIBROSUM.

1. A fruiting branch, natural size.
2. The ripe fruit, enlarged.
3. Vertical section of a ripe carpel, enlarged.
4. Cross section of a seed, enlarged.
5. An embryo, much enlarged.

C.E. Faxon del.

Picart fr. sc.

XANTHOXYLUM CRIBROSUM, Spreng.

A. Riocreux direx.t

Imp. R. Taneur. Paris.

C. E. Faxon del.

Picart fr. sc.

XANTHOXYLUM CRIBROSUM, Spreng.

A. Riocreux direx.t

Imp. R. Taneur, Paris.

XANTHOXYLUM FAGARA.

Wild Lime.

FLOWERS in axillary clusters; sepals and petals 4. Leaves persistent.

Xanthoxylum Fagara, Sargent, *Garden and Forest*, iii. 186.

Schinus Fagara, Linnæus, *Spec.* 389.

Pterota subspinosa, Browne, *Nat. Hist. Jam.* 146, t. 5, f. 1.

Fagara Pterota, Linnæus, *Amœn.* v. 393; *Mant.* 331. — Miller, *Dict.* ed. 8. — Lamarck, *Dict.* ii. 444; *Ill.* i. 335, t. 84. — Willdenow, *Spec.* i. 666. — Lunan, *Hort. Jam.* ii. 146. — Titford, *Hort. Bot. Am.* 40. — Turpin, *Dict. Sci. Nat.* xvi. 107, t. 127.

Fagara tragodes, Jacquin, *Enum. Pl. Carib.* 12; *Stirp. Am.* 21, t. 14.

Fagara lentiscifolia, Willdenow, *Enum.* i. 165. — Grisebach, *Fl. Brit. W. Ind.* 137.

X. Pterota, Humboldt, Bonpland & Kunth, *Nov. Gen. et Spec.* vi. 3. — Kunth, *Syn.* iii. 325. — De Candolle, *Prodr.* i. 725. — Don, *Gen. Syst.* i. 802. — Torrey & Gray, *Fl. N. Am.* i. 680. — Macfadyen, *Fl. Jam.* 190. — Dietrich, *Syn.* ii. 1000. — Nuttall, *Sylva*, iii. 11, t. 84. — Seeman, *Bot. Herald*, 275. — Torrey, *Bot. Mex. Bound. Surv.* 43. — Chapman, *Fl.* 66. — Triana & Planchon, *Ann. Sci. Nat.* ser. 5, xiv. 311. — Engler, *Martius Fl. Brasil.* xii. 2, 154. — Hemsley, *Bot. Biol. Am. Cent.* i. 169. — Sargent, *Forest Trees N. Am.* 10*th Census U. S.* ix. 31.

A tree, occasionally reaching the height of twenty-five or thirty feet, with a slender, often inclining trunk and fastigiate branches; or more frequently a tall or low shrub. The bark of the trunk is an eighth of an inch thick, the smooth light gray surface covered with small appressed persistent scales. The branchlets are more or less zigzag, slender, covered with smooth dark gray bark, and armed with sharp hooked stipular prickles. The leaves are three or four inches long, with broadly winged jointed petioles, and are composed of three or four pairs and a terminal leaflet. The leaflets are obovate, rounded or emarginate at the apex, minutely crenulate-toothed above the middle, sessile, half an inch long or less, coriaceous, glandular-punctate, bright green and lustrous especially on the upper surface, and furnished with minute hooked deciduous stipular prickles. The staminate and pistillate flowers are produced on separate plants. The short axillary contracted cymes appear singly or in pairs from April until June on the branches of the previous year from minute dark brown globular buds. The flowers are small and are borne on short pedicels from the axils of minute ovate-obtuse deciduous bracts. The sepals are membranaceous and much shorter than the ovate yellow-green petals. The sterile flowers have four exserted stamens with slender filaments and a rudimentary pistil crowned by the incurved rudimentary styles. The fertile flowers are destitute of stamens, and have two pistils with ovate-sessile ovaries, gradually contracted into long slender subulate exserted styles, connivent near the apex and crowned with obliquely spreading stigmas. The fruit, which ripens in September, is obovate, rusty brown, rugose, and less than a quarter of an inch long, and contains a single seed covered with a bright shining coat.

Xanthoxylum Fagara is widely distributed on the coast and islands of Florida south of Mosquito Inlet, and latitude twenty-nine north on the west coast; and in Texas from Matagorda Bay to the Rio Grande. It is common in north Mexico, and is widely distributed through the West Indian islands, southern Mexico, and Central and South America as far south as Brazil and Peru. This species is one of the commonest of the south Florida plants, where it usually grows as a tall slender shrub, assuming a truly arborescent habit on the rich hummock soil of Eliott's Key and the shores of Bay Biscayne. In Texas it is generally shrubby, although occasionally reaching tree-like proportions in the neighborhood of Matagorda Bay.

The wood of *Xanthoxylum Fagara* is heavy, hard, and very close-grained; it is brown tinged with red, and contains numerous thin medullary rays. The thin sapwood, composed of ten or twelve layers

of annual growth, is yellow. The specific gravity of the absolutely dry wood is 0.7444, a cubic foot of the dry wood weighing 46.39 pounds.

Paul Hermann[1] published in 1689 the earliest account of *Xanthoxylum Fagara;* the first figure is that of Plukenet,[2] published in 1691. It was discovered in Florida by Dr. J. L. Blodgett, and in Texas on Matagorda Bay in February, 1845, by Mr. Ferdinand Lindheimer.[3]

Xanthoxylum Fagara[4] was cultivated in England as early as 1782 by Philip Miller.[5]

[1] "*An Coriaria Arbor spinosa Acaciæ foliis & facie, Parad. Bat. Prodr.*"

[2] *Rhus Obsoniorum similis leptiphyllos, Tragôdes, Americana, spinosa, rachi medio appendicibus aucto, Alm. Bot.* 319, t. 107, f. 4.

Lauro affinis Jasmini folio alato, costa media membranulis utrinque extantibus alata, ligni duritie ferro vix cedens, Sloane, *Cat. Pl. Jam.* 137; *Nat. Hist. Jam.* ii. 25, t. 162, f. 1. — Ray, *Hist. Pl. Dendr.* iii. 86.

Schinoides petiolis subtus aculeatis, Linnæus, *Hort. Cliff.* 489.

Schinus foliis pinnatis; foliolis ov.-oblongis, petiolo marginato articulato inermi, Linnæus, *Mat. Med.* 187.

[3] Ferdinand Lindheimer (1801–1879), a German resident of Texas, where he was a most assiduous and successful botanical collector and observer during a period of more than thirty years. He was a member of the German colony at New Braunfels, where he edited a newspaper and where he died. He discovered a large number of new plants, among them *Lindheimera Texana,* a well-known garden annual. Many of his discoveries were published by Engelmann and Gray in the Journal of the Boston Society of Natural History (*Plantæ Lindheimerianæ*).

[4] Fagara was early used by the Arabians to designate an aromatic plant of which the name is now lost (Wittstein, *Etymolog. Bot. Hand.*). It was afterwards taken up by Clusius and the apothecaries to designate, under the name of *Fagaræ majores,* the aromatic fruit of some eastern tree, probably of *Xanthoxylum Rhetsa,* DC, of India. Linnæus, under the impression, perhaps, that the American plant was identical with the tree which produced the *Fagaræ* of commerce, gave it the specific name Fagara.

[5] Aiton, *Hort. Kew.* i. 161.

EXPLANATION OF THE PLATE.

Plate XXXII. Xanthoxylum Fagara.

1. A flowering branch of a staminate tree, natural size.
2. A flowering branch of a pistillate tree, natural size.
3. A staminate flower, enlarged.
4. Vertical section of a staminate flower, enlarged.
5. A pistillate flower, enlarged.
6. Vertical section of a pistillate flower, enlarged.
7. Cluster of fruit, natural size.
8. A ripe carpel, enlarged.
9. Vertical section of a seed, enlarged.

C.E. Faxon del.

Picart fr. sc.

XANTHOXYLUM FAGARA, Sarg.

A. Riocreux direx.t

Imp. R. Taneur, Paris.

PTELEA.

FLOWERS polygamous; calyx 4 or 5-parted, the lobes imbricated in æstivation; petals 4 or 5, imbricated in æstivation, hypogynous. Fruit, a 2 or 3-celled broadly winged, or rarely wingless, indehiscent samara. Leaves trifoliate, or rarely pinnately quinquefoliate.

Ptelea, Linnæus, *Gen.* 29. — A. L. de Jussieu, *Gen.* 375. — Endlicher, *Gen.* 1147. — Meisner, *Gen.* 65. — Gray, *Gen. Ill.* ii. 149; *Proc. Am. Acad.* n. ser. xxiii. 224. — Bentham & Hooker, *Gen.* i. 301. — Baillon, *Hist. Pl.* iv. 482.

Belluccia, Adanson, *Fam. Pl.* ii. 344.

Small unarmed trees or shrubs, with smooth bitter bark, slender terete branches, small depressed almost subpetiolar buds, and thick fleshy acrid roots. Leaves alternate or rarely opposite, destitute of stipules, long petiolate, usually trifoliate, the leaflets conduplicate in vernation, ovate or oblong, entire, crenate or serrulate, punctate with pellucid dots. Flowers produced on slender bracteolate pedicels in terminal cymes or compound corymbs, greenish white. Receptacle convex, inconspicuous. Calyx parted nearly to the base, much shorter than the petals, deciduous. Petals spreading, deciduous. Stamens three or four, alternate with and as long as the petals, hypogynous; much shorter in the fertile flowers with imperfect or rudimentary anthers; filaments subulate, more or less pilose towards the base, especially on the inner surface; anthers ovate or cordate, introrse, two-celled; the cells opening longitudinally. Pistil raised on a short gynophore; abortive and nearly sessile in the sterile flowers; ovary compressed, two to three-celled; style short; stigma two to three-lobed; ovules two in each cell, inserted one above the other, ascending, amphitropous, raphe ventral, micropyle superior, the upper ovule only fertilized. Fruit orbicular, surrounded by a broad reticulate wing, or rarely nut-like and wingless. Seed oblong; testa smooth or slightly wrinkled, coriaceous; albumen fleshy. Embryo straight; cotyledons ovate-oblong; radicle short, superior.

The genus Ptelea is confined to the United States and Mexico. Four or five species are known. *Ptelea trifoliata*, a small tree, and the only arborescent species of the genus, ranges from southern Ontario to Mexico. *Ptelea angustifolia*[1] inhabits the Atlantic-coast region from South Carolina to Florida, and is common from Texas to California, extending north to the mountains of Colorado and south into northern Mexico. One, and perhaps two species occur in southern Mexico,[2] and one species in the peninsula of Lower California.[3]

The bark and foliage of Ptelea is bitter and strong-scented, and possesses tonic and anthelmintic properties.

The name Ptelea, derived from the Greek πτελέα, a classical name of the Elm-tree, was transferred by Linnæus to this genus from the resemblance of its winged fruit to that of the Elm.

[1] Bentham, *Pl. Hartweg.* 9. — Brewer & Watson, *Bot. Cal.* i. 97. (*P. Baldwinii*, Torrey & Gray, *Fl. N. Am.* i. 215. — Chapman, *Fl.* 67.)

[2] Hemsley, *Bot. Biol. Am. Cent.* i. 171.

[3] *Ptelea aptera*, Parry, *Proc. Davenport Acad. Sci.* iv. 39, a low aromatic shrub from the shores of Todos-Santos Bay, distinguished by its remarkable nut-like glandular turgid fruit, surrounded by a narrow rudimentary wing, or quite wingless.

PTELEA TRIFOLIATA.

Hop Tree. Wafer Ash.

FLOWERS polygamo-monœcious. Fruit broadly winged. Leaves usually trifoliate.

Ptelea trifoliata, Linnæus, *Spec.* 118. — Miller, *Dict.* ed. 8. — Medicus, *Bot. Beobacht.* 215. — Marshall, *Arbust. Am.* 115. — Walter, *Fl. Car.* 88. — Lamarck, *Ill.* i. 336, t. 84. — Moench, *Meth.* 55. — Willdenow, *Spec.* i. 670; *Enum.* i. 166. — *Nouveau Duhamel*, i. 251, t. 57. — Michaux, *Fl. Bor.-Am.* i. 99. — Schkuhr, *Handb.* i. 83, t. 25. — Poiret, *Lam. Dict.* v. 706. — Persoon, *Syn.* i. 145. — Desfontaines, *Hist. Arb.* ii. 344. — Robin, *Voyages*, iii. 509. — Pursh, *Fl. Am. Sept.* i. 107. — Nuttall, *Gen.* i. 104. — Guimpel, Otto & Hayne, *Abbild. Holz.* 94, t. 74. — Hayne, *Dendr. Fl.* 8. — Elliott, *Sk.* i. 210. — Roemer & Schultes, *Syst.* iii. 291. — Torrey, *Fl. U. S.* 189; *Fl. N. Y.* i. 133. — De Candolle, *Prodr.* ii. 82. — Sprengel, *Syst.* i. 441. — Turpin, *Dict. Sci. Nat.* xliv. 2, t. 128. — A. de Jussieu, *Mém. Mus.* xii. t. 26, f. 42. — Don, *Gen. Syst.* i. 806. — Spach, *Hist. Veg.* ii. 369. — Lindley, *Fl. Med.* 215. — Loudon, *Arb. Brit.* i. 489, t. — Torrey & Gray, *Fl. N. Am.* i. 215. — Dietrich, *Syn.* i. 497. — Gray, *Gen. Ill.* ii. 150, t. 157. — Agardh, *Theor. et Syst. Pl.* t. 19, f. 7, 8. — Chapman, *Fl.* 66. — Curtis, *Rep. Geolog. Surv. N. Car.* 1860, iii. 107. — Schnizlein, *Icon.* t. 250, f. 15–26. — Baillon, *Hist. Pl.* iv. 395, f. 445, 446. — Koch, *Dendr.* i. 566. — Hemsley, *Bot. Biol. Am. Cent.* i. 171. — Sargent, *Forest Trees N. Am.* 10*th Census U. S.* ix. 31. — Watson & Coulter, *Gray's Man.* ed. 6, 107.

P. pentaphylla, Fabricius, *Enum. Pl. Helmst.* 416.

P. viticifolia, Salisbury, *Prodr.* 68.

A small round-headed tree, rarely twenty or twenty-five feet in height, with a straight slender trunk six or eight inches in diameter; or, more often, a low spreading shrub. The bark of the trunk is rarely more than an eighth of an inch thick, with a smooth dark gray surface marked with numerous oblong wart-like excrescences which also appear on the dark brown lustrous bark of the young branches. These are conspicuously marked during the winter by the scars left by the falling of the leaf-stalks, which almost surround and cover the depressed nearly round buds which are pale or almost white, and covered with scattered silky hairs. The leaves are alternate, or rarely opposite, and are borne on stout petioles with thickened bases, and two and a half to three inches long. When they first appear they are covered, as are the young shoots, the branches of the inflorescence, and the petioles, with short fine pubescence, and become glabrous at maturity. The leaflets are sessile, ovate or oblong and pointed, the terminal one generally larger and more gradually contracted at the base than the others; they are entire or finely serrate, rather coriaceous at maturity, dark green and lustrous on the upper surface, pale on the lower, four to six inches long by two and a half to three inches broad, with prominent midribs and primary veins. The flowers appear in the extreme south as early as March, and in the north during the early part of the month of June. The fertile and sterile flowers are produced together in compound terminal spreading cymes, the sterile flowers being usually less numerous and falling soon after the opening of their anther cells. The slender pedicels, an inch or an inch and a half long, are thickly covered with pubescence, as are the calyx and the ovate-oblong petals. The ovary is puberulent. The fruit with its wing is almost orbicular, or sometimes slightly obovate, and nearly an inch across. It ripens in Florida in early summer, or at the north late in the autumn, and hangs at maturity on long slender reflexed pedicels, the remnants of which remain upon the branches until the plants begin their growth the following spring.

Point Pelee on the north shore of Lake Ontario is the point farthest north where *Ptelea trifoliata* has been observed growing naturally.[1] It is found on Long Island, New York; it is common in Pennsylvania, and thence extends west to Minnesota and south to northern Florida and through Texas and

[1] J. W. Burgess, *Bot. Gazette*, vii. 95.

New Mexico to the valley of the Mimbres River and the mountains of Colorado[1] and northern Mexico. *Ptelea trifoliata* generally grows on rocky slopes near the borders of the forest, often in the shade of larger trees.

The wood of *Ptelea trifoliata* is heavy, hard, and close-grained, with a satiny surface. The medullary rays are thin and not numerous, but the layers of annual growth are clearly marked by two or three rows of open ducts. The color of the heartwood is yellow-brown, the thin sapwood, composed of six to eight layers of annual growth, being hardly distinguishable from it. The specific gravity of the absolutely dry wood is 0.8319, a cubic foot of the dry wood weighing 51.84 pounds.

Herbalists employ the bitter bark of the roots of *Ptelea trifoliata* in the form of tinctures and fluid extracts as a tonic in the treatment of dyspepsia and debility;[2] and the bitter fruit is said to be sometimes used domestically as a substitute for hops in beer-brewing.[3]

The earliest description of *Ptelea trifoliata* is that of Plukenet, published in 1696 in the *Almagestum Botanicum*.[4] It was cultivated in England as early as 1724[5] by Dr. James Sherard,[6] in his garden at Eltham, and has since been an esteemed plant in gardens, where, at different times, forms with variegated or blotched foliage have appeared.

Ptelea trifoliata is the favorite food of a Tree-hopper which punctures its branches,[7] and the larvæ of a Tineid moth[8] are known to disfigure the leaves.[9]

Ptelea trifoliata flourishes in rich rather moist soil, and may be easily propagated from seed which, if planted as soon as it is ripe, germinates the following spring.

There is a shrubby form of this species, smaller in all its parts than that represented in our figure, more pubescent, and with the under surface of the leaves often coated with thick white tomentum.[10] It is not rare in the south Atlantic states near the coast and in Florida; it is the common form of western Texas and New Mexico.

[1] Cañon City, Hooker & Gray (1877), in *Herb. Gray.*

[2] *Am. Jour. Pharm.* 1862, 198; 1867, 337. — *Nat. Disp.* ed. 2, 1179.

[3] This statement of the use of the fruit of Ptelea has been repeated in most of the published accounts of the tree. I have no reason for supposing that it is now used for this purpose.

[4] *Frutex Virginianus trifolius Ulmi Samarris Banisteri*, 159. — Dillenius, *Hort. Elth.* 147, t. 122, f. 148. — Catesby, *Nat. Hist. Car.* ii. 83, t. 83. — Linnæus, *Hort. Cliff.* 36.

Ptelea foliis ternatis, Miller, *Icon. Dict.* ii. 141, t. 211.

[5] Aiton, *Hort. Kew.* i. 162.

[6] James Sherard, M. D. (1666–1737), brother of the more distinguished William Sherard, who was one of the most eminent botanists of his time and the founder of the Botanic Garden at Oxford. James Sherard, a successful London physician and apothecary, was devoted to botany and horticulture. His garden at Eltham in Kent was one of the richest of its time in England, and was made famous by Dillenius in his sumptuous *Hortus Elthamensis*, published in 1732, in which he figured many of the plants cultivated by Dr. Sherard.

[7] *Echenopa binotata*, Say, *First Ann. Rep. State Entomol. N. Y.* 287.

[8] *Nepticula pteleœella.*

[9] The foliage of *Ptelea trifoliata* is ruined every year during the month of August in the neighborhood of Covington, Kentucky, by the larvæ of this species. (T. V. Chambers, *Psyche*, iii. 137.)

[10] *Ptelea trifoliata*, var. *mollis*, Torrey & Gray, *Fl. N. Am.* i. 680. — Engelmann & Gray, *Jour. Bost. Soc. Nat. Hist.* v. 33 (*Pl. Lindheim.*). — Torrey, *Marcy's Rep.* 269. — Gray, *Pl. Wright.* i. 31 (*Smithsonian Contrib.* iii.). — Watson, *Proc. Am. Acad.* xvii. 335. — Sargent, *Forest Trees N. Am.* 10*th Census U. S.* ix. 31.

P. mollis, Curtis, *Am. Jour. Sci.* ser. 2, vii. 406; *Rep. Geolog. Surv. N. Car.* 1860, iii. 107. — Walpers, *Ann.* ii. 259. — Chapman, *Fl.* 67.

EXPLANATION OF THE PLATES.

Plate XXXIII. Ptelea trifoliata.

1. A flowering branch, natural size.
2. Diagram of a fertile flower.
3. A sterile flower, enlarged.
4. Vertical section of a sterile flower, enlarged.
5. Posterior and anterior views of a stamen, enlarged.
6. A fertile flower, enlarged.
7. Vertical section of a pistil, enlarged.
8. Cross section of an ovary, enlarged.

Plate XXXIV. Ptelea trifoliata.

1. A fruiting branch, natural size.
2. Vertical section of a fruit, natural size.
3. A seed, enlarged.
4. Vertical section of a seed, enlarged.
5. An embryo, much enlarged.

C.E. Faxon del. Picart fr. sc.

PTELEA TRIFOLIATA, L.

A. Riocreux direx.t Imp. R. Taneur, Paris.

C.E. Faxon del.

Picart fr. sc.

PTELEA TRIFOLIATA, L.

A. Riocreux direx.t

Imp. R. Taneur, Paris.

HELIETTA.

FLOWERS regular, perfect; calyx 3 to 4-parted, the divisions imbricated in æstivation; petals 3 to 4, imbricated in æstivation, hypogynous. Fruit composed of 3 to 4 winged indehiscent coccules. Leaves trifoliate, persistent.

Helietta, Tulasne, *Ann. Sci. Nat.* ser. 3, vii. 280. — Bentham & Hooker, *Gen.* i. 301. — Baillon, *Hist. Pl.* iv. 477. —Engler, *Martius Fl. Brasil.* xii. 2, 184.

Trees or shrubs, with slender terete branches. Leaves opposite, long-petiolate; leaflets sessile, obovate-oblong, obtuse, entire or crenate, subcoriaceous, glandular-punctate, the terminal much larger than the two lateral. Flowers produced on slender bibracteolate pedicels in terminal or axillary panicles. Sepals slightly united at the base, persistent, much shorter than the oblong concave glandular-punctate petals reflexed at maturity. Stamens inserted under the disk; filaments shorter than the petals, slightly flattened, glabrous; anthers ovate, slightly cordate at the base, attached on the back below the middle, introrse, two-celled, the cells opening longitudinally. Disk free, cup-shaped, erect, subcorrugated, with a sinuate margin, entire or four-lobed, the lobes entire or crenate and opposite the petals. Ovary minute, sessile, depressed, three to four-lobed, glandular-verrucose or minutely pilose, the lateral lobes slightly compressed; styles united into a single slender column, crowned by the globose three to four-lobed stigma; ovules two in each cell, collateral, anatropous. Fruit obconical, composed of three to four dry woody carpels with prominent horizontal wings, separating at maturity into three to four one-seeded indehiscent coccules. Seed linear, oblong, inclosed in a cartilaginous indehiscent endocarp; testa crustaceous, fragile, black. Embryo axile, surrounded by thin fleshy albumen; cotyledons straight, obtuse; radicle terete, superior.

The genus Helietta is widely distributed from the valley of the Rio Grande in Texas to Brazil and Paraguay. Four species are now recognized by botanists. *Helietta parvifolia* is peculiar to northeastern Mexico and the adjacent portions of Texas. *Helietta Plæana*,[1] the type of the genus, is a native of Colombia. *Helietta multiflora*[2] is Brazilian, and *Helietta apiculata*,[3] described as a small tree, is found in Paraguay.

The genus Helietta was named by Tulasne in honor of Louis Théodore Hélie,[4] a distinguished French physician who studied the poisonous properties of the Rue.[5]

[1] Tulasne, *Ann. Sci. Nat.* ser. 3, vii. 281.

[2] Engler, *Martius Fl. Brasil.* xii. 2, 183, t. 39.

[3] Bentham, *Hook. Icon.* xiv. 67.

[4] Louis Théodore Hélie (1804–1867); born in Nantes, graduated in medicine at Paris in 1827, and professor of anatomy and physiology in the school of medicine of his native city, in which he founded a museum of anatomy. He contributed numerous articles to medical journals, and at the time of his death was an officer of the Legion of Honor, and a member of many learned societies.

[5] "De l'action vénéneuse de la Rue, et de son influence sur la grossesse." (*Annales d'Hygiène Publique*, Paris, 1838, xx. 180.)

HELIETTA PARVIFOLIA.

Baretta.

SEPALS and petals 4; disk 4-lobed.

Helietta parvifolia, Bentham, *Hook. Icon.* xiv. 66. — V. Havard, *Proc. U. S. Nat. Mus.* viii. No. 29, 475. — Sargent, *Garden and Forest*, ii. 352.

Ptelea parvifolia, Hemsley (ex. char. A. Gray in *Herb. Kew.*), *Bot. Biol. Am. Cent.* i. 170.

A slender tree, twenty or twenty-five feet in height, with a trunk five or six inches in diameter, and rather erect branches forming a small irregular head; or a low shrub. The bark of the trunk is an eighth of an inch thick, the surface covered with dark brown closely appressed scales which separate in large irregular patches, leaving when they fall a smooth pale yellow surface. The bark of the branchlets is pale, covered with minute wart-like excrescences; it is minutely puberulous when they first appear, soon becoming glabrous, and is marked during the second year with small inconspicuous leaf-scars. The leaves remain on the branches until March or April, when the new growth begins. They are borne on stout slightly club-shaped petioles, which are at first puberulent, and become glabrous at maturity. The leaflets are oblong or narrowly obovate, rounded or sometimes slightly emarginate at the apex, and gradually and regularly contracted at the base; they are entire or slightly and remotely crenulate-serrate, yellow-green and lustrous on the upper surface, paler below, and conspicuously marked with black glandular dots; the terminal leaflet, which is sometimes wanting, is half an inch to an inch and a half long, sometimes half an inch broad, and nearly double the size of the two lateral leaflets. The flowers, which open in April and May, are produced in dichotomously-branched subsessile panicles on the shoots of the season from the axils of the upper leaves above which they hardly appear. The flower-buds are round, obtusely-flattened, and covered with pubescence. The bracts of the pedicels are minute, acuminate, and early-deciduous, and, like the petioles and calyx, are covered at first with short dense pubescence. The petals are white, ovate, an eighth of an inch long or nearly so, with scattered hairs on the outer surface, and thin scabrous margins, and are four or five times longer than the calyx-lobes. The disk is four-lobed with entire margins, and, like the four-lobed ovary and slender style, is minutely glandular-punctate. The fruit, of which only two or three specimens appear to mature from a panicle, ripens in October; it is oblong, a quarter to a third of an inch long, and produced into a rigid broadly ovate, sometimes slightly falcate wing, rounded at the apex, half an inch long, and conspicuously reticulate-veined.

Helietta parvifolia forms thickets of considerable extent near Rio Grande City in Texas, where it is a common shrub. It was first noticed there by Dr. Valéry Havard[1] in 1883, and is not known elsewhere within the limits of the United States. Helietta is rather common on the mesas south of the lower Rio Grande, where it is found with the Acacias, Buckthorns, Yuccas and Cacti, the Texas Persimmon, and the Parkinsonias, which form the characteristic features of the flora of that region, and

[1] Valéry Havard was born near Compiègne in France in 1846, and was educated at Beauvois, where he followed assiduously in the Agricultural Institute courses in botany and in other departments of Natural History. Havard emigrated in 1866 to the United States, and obtained the appointment of professor in Manhattan College, New York. Four years later he graduated in medicine from the University Medical College of New York, and in 1874 received the appointment of assistant surgeon in the United States army. Dr. Havard's knowledge of botany has enabled him to make many interesting and important discoveries in connection with his official duties in various parts of the country, especially in Dakota, Montana, and western Texas. His description of the natural features of western and southern Texas, published in the *Proceedings of the United States National Museum* for 1885, gives a detailed account of the distribution of the plants of this interesting region, and of their economic properties and uses, and is an important botanical paper containing much information which had not previously been made known.

reaches the lower slopes of the Sierra Madre, along which it extends southward through the State of Nuevo Leon, flourishing on limestone ledges where it attains its largest size and tree-like habit in the fertile soil and comparatively humid atmosphere of that region.

The wood of *Helietta parvifolia* is hard, very heavy and close-grained; it contains numerous thin medullary rays, the layers of annual growth being marked by several rows of minute open ducts. It is light orange-brown, the sapwood, which is not otherwise distinguishable, being rather lighter colored. The specific gravity of the absolutely dry wood is 0.8785, a cubic foot weighing 54.75 pounds. It is probably used for fuel only.

Helietta parvifolia was discovered near Monterey by Mr. J. L. Berlandier[1] in 1828.

[1] Jean Louis Berlandier, a native of Belgium, was a pupil of De Candolle, under whose auspices he published at Geneva, in 1828, a *Mémoire sur la Famille des Grossulariées*, also elaborating these plants for the *Prodromus* of De Candolle (iii. 477–483). Berlandier left Europe probably in 1827 or 1828, and established himself as an apothecary at Matamoros in Mexico. He was the first botanist to explore Nuevo Leon, where he made large collections and many discoveries, as he did later in western Texas also. At the breaking out of the war between the United States and Mexico, Berlandier espoused the cause of the former, and was present as guide at the battle of Resaca de la Palma and at some of the other combats which took place at the beginning of the war north of the Rio Grande. He was drowned in 1851 in attempting to cross on horseback one of the small streams which flow into the Gulf of Mexico south of the Rio Grande. The manuscripts of Berlandier's published papers, the notes of some of his Mexican journeys, and a number of his unpublished paintings of Mexican plants, are preserved in the herbarium of Harvard University. The genus *Berlandiera*, dedicated to him by De Candolle, commemorates his services to botany.

EXPLANATION OF THE PLATE.

Plate XXXV. Helietta parvifolia.

1. A flowering branch, natural size.
2. Diagram of a flower.
3. A flower, enlarged.
4. Vertical section of a flower, enlarged.
5. A flower, the calyx and petals removed, enlarged.
6. An ovule, much magnified.
7. A fruiting branch, natural size.
8. Vertical section of a carpel, enlarged.
9. A seed, enlarged.
10. An embryo, much magnified.

C.E. Faxon del. Picart fr. sc.

HELIETTA PARVIFOLIA, Benth.

A. Riocreux direx.t Imp. R. Taneur, Paris.

AMYRIS.

FLOWERS hermaphrodite or polygamous; calyx gamosepalous, 4-toothed; petals 4, imbricated in æstivation, hypogynous. Fruit, a 1-seeded drupe. Leaves 1 to 3-foliate or unequally pinnate.

Amyris, Linnæus, *Gen.* ed. 6, 188. — A. L. de Jussieu, *Gen.* 371 (in part). — Endlicher, *Gen.* 1139. — Meisner, *Gen.* 74. — Bentham & Hooker, *Gen.* i. 327. — Triana & Planchon, *Ann. Sci. Nat.* ser. 5, xiv. 320. — Baillon, *Hist. Pl.* iv. 483. — Gray, *Proc. Am. Acad.* n. ser. xxiii. 226.

Glabrous glandular-punctate trees or shrubs, with balsamic resinous juice. Leaves opposite, or rarely opposite and alternate, destitute of stipules, persistent, the petioles often winged; leaflets opposite, petiolulate, entire or crenate. Flowers white, minute, produced generally in three-flowered corymbs in terminal or axillary branched panicles, bibracteolate at the base of the branches. Pedicels slender, bibracteolate. Petals much longer than the minute calyx, spreading at maturity. Disk of the staminate flowers inconspicuous; that of the pistillate and perfect flowers thickened and pulvinate. Stamens eight, hypogynous, opposite and alternate with the petals; filaments filiform, exserted; anthers ovate, attached on the back below the middle, introrse, two-celled, the contiguous cells opening longitudinally. Ovary ellipsoidal or ovoid, one-celled, rudimentary or sterile in the staminate flowers; style short, terminal, or wanting; stigma capitate; ovules two, collateral, suspended near the apex of the ovary, anatropous; micropyle superior. Drupe globose or ovoid, aromatic; putamen one-seeded by abortion, chartaceous. Seed pendulous, exalbuminous; testa membranaceous. Embryo minute; cotyledons plano-convex, fleshy, glandular-punctate; radicle very short, superior.

The genus Amyris[1] is tropical American and north Mexican. Twelve or fourteen species[2] are distinguished, two extending into the territory of the United States; one of these, *A. maritima*, a small West Indian tree, is common on the shores of south Florida. *Amyris parvifolia*,[3] a shrub of the Sierra Madre of Mexico, has been noticed in Texas near the mouth of the Rio Grande.

The plants of this genus are fragrant and yield a balsamic resin which, in *Amyris sylvatica*,[4] is aromatic and stimulant. *Amyris balsamifera*[5] of the same region is reputed poisonous. The branches of this tree produce in burning an agreeable odor, recalling that of roses, and fires are made with them to perfume dwellings.[6] The wood of Amyris is heavy, hard, and close-grained. It furnishes valuable fuel, and is sometimes employed in cabinet-making. According to Baillon, the Lemon-wood[7] of commerce is produced by *Amyris sylvatica*.

The name Amyris, derived from μύῤῥα, relates to the balsamic properties of the plants of this genus.

[1] Amyris was formerly united with *Burseraceæ*. Hooker, in the *Genera Plantarum*, although he retained the genus at the end of that family, suggested that it might be united more properly with *Aurantieæ* in *Rutaceæ*. Triana & Planchon (*Ann. Sci. Nat.* ser. 5, xiv. 320) adopted this view, pointing out that the flower and fruit of Amyris and Glycosmis are so similar that these two types cannot be separated, and that if Glycosmis, in spite of its short persistent style, is to remain in *Rutaceæ*, it is necessary to place Amyris with it. The genus is, however, widely separated geographically from the other *Aurantieæ* which are confined to the Old World, and are destitute, moreover, of the resinous gum peculiar to Amyris.

[2] Browne, *Nat. Hist. Jam.* 208. — Jacquin, *Stirp. Am.* 107. — Humboldt, Bonpland & Kunth, *Nov. Gen. et Spec.* vii. 37, t. 610. — De Candolle, *Prodr.* ii. 81. — Walpers, *Rep.* i. 560; ii. 831; v. 420; *Ann.* vii. 552. — Macfadyen, *Fl. Jam.* 230. — Grisebach, *Fl. Brit. W. Ind.* 174. — Triana & Planchon, *Ann. Sci. Nat.* ser. 5, xiv. 321. — Karsten, *Fl. Columb.* t. 158. — Hemsley, *Bot. Biol. Am. Cent.* i. 180.

[3] Gray, *Proc. Am. Acad.* n. ser. xxiii. 226.

[4] Jacquin, *Stirp. Am.* 107.

[5] Linnæus, *Spec.* ed. 2, 496 (*A. toxifera*, Willd. *Spec.* ii. 336).

[6] Triana & Planchon, *l. c.*

[7] *Hist. Pl.* iv. 448.

AMYRIS MARITIMA.

Torch Wood.

FLOWERS perfect. Leaves 3-foliolate.

Amyris **maritima**, Jacquin, *Enum. Pl. Carib.* 23; *Stirp. Am.* 107. — Linnæus, *Spec.* ed. 2, 496. — De Candolle, *Prodr.* ii. 81. — Macfadyen, *Fl. Jam.* 231. — Richard, *Fl. Cub.* 392. — Grisebach, *Fl. Brit. W. Ind.* 174 (in part). — Planchon & Triana, *Ann. Sci. Nat.* ser. 5, xiv. 324. — Baillon, *Hist. Pl.* iv. 397, f. 447–451; *Dict.* i. 159, f. — Gray, *Proc. Am. Acad.* n. ser. xxiii. 226.

A. **Elemifera**, Linnæus, *Spec.* ed. 2, 495.

A. **sylvatica**, De Candolle, *Prodr.* ii. 81 (in part). — Grisebach, *Fl. Brit. W. Ind.* 174 (in part). — Sargent, *Forest Trees N. Am.* 10*th Census U. S.* ix. 33.

A. **dyatripa**, Sprengel, *Neue End.* iii. 48. — De Candolle, *Prodr.* ii. 81.

A. **Floridana**, Nuttall, *Am. Jour. Sci.* v. 294; *Sylva*, ii. 114, t. 78. — De Candolle, *Prodr.* ii. 81. — Torrey & Gray, *Fl. N. Am.* i. 221. — Loudon, *Arb. Brit.* ii. 561. — Chapman, *Fl.* 68.

A. **maritima**, var. **angustifolia**, Gray, *Proc. Am. Acad.* n. ser. xxiii. 226.

A small slender tree, forty or fifty feet in height, with a trunk sometimes, although rarely, a foot in diameter, covered with thin gray-brown bark slightly furrowed and broken into short appressed scales. The branches are slender, terete, covered with wart-like excrescences; they are light brown at first and become gray during their second season. The winter-buds are acute, flattened, an eighth of an inch long, with broadly obovate scales slightly keeled on the back. The leaves are borne on slender petioles, an inch or an inch and a half in length, slightly thickened towards the base. The leaflets are broadly ovate or roundish, obtuse, acute or acuminate at the apex, distinctly wedge-shaped at the base, or sometimes ovate-lanceolate or rhombic-lanceolate.[1] They are entire or remotely crenulate, coriaceous, lustrous on both surfaces, dark yellow-green, conspicuously reticulate-veined, and covered on the lower surface with minute black glandular dots. They are an inch to two and a half inches long, and are borne on slender petioles, that of the terminal leaflet being often twice the length of those of the lateral leaflets, and often an inch or more long. The panicles of flowers are terminal, pedunculate or nearly sessile, and appear in Florida from August to December. The filaments of the four stamens which are opposite the sepals are sometimes a little longer than those which alternate with them.[2] The fruit ripens in the spring; it is ovoid, nearly half an inch long or sometimes much smaller. The fleshy outer covering is black, covered with a glaucous bloom when fully ripe, and possesses an aromatic oily rather agreeable flavor.

Amyris maritima is found in Florida from Mosquito Inlet on the east coast to the southern keys, where it is a common plant, growing in different situations, from the immediate neighborhood of the shore to the rich hummocks of the interior. It grows also on the Bahama Islands, on St. Thomas, Cuba, Jamaica, and no doubt on several of the other West Indian islands. In Florida it attains its greatest size on Umbrella Key, where trees fifty feet in height are not uncommon.

The wood of *Amyris maritima* is heavy, exceedingly hard, strong, and close-grained; it is very resinous, extremely durable, and can be made to take a beautiful polish. The medullary rays are thin

[1] In the variety *angustifolia*, which does not appear to differ otherwise from the more robust forms except in the feebler growth and the smaller foliage and fruit due to the poor soil and exposed situation on the borders of sea-beaches where it is found. The extreme forms, characterized by Gray (*l. c.*), pass one into the other as surroundings and conditions of growth are more or less favorable.

[2] Baillon, in his figure of this species, represents the filaments of the four stamens opposite the petals as fully a third shorter than those which alternate with them. There is, however, no such difference in the length of the filaments in any of the Florida specimens I have examined. In a specimen (No. 178) collected by Baron Eggers on St. Thomas in 1887, the stamens show a greater inclination to vary in length. This specimen was collected in full flower in April, showing that the flowering period of this tree varies considerably in different latitudes.

and obscure. It is light orange-colored with a thin, rather lighter colored sapwood composed of twelve or fifteen layers of annual growth. The specific gravity of the absolutely dry wood is 1.0459, a cubic foot weighing 65.18 pounds. It furnishes excellent fuel, and is used for this purpose by the inhabitants of the Florida keys. The hardness, strength, and durability of this wood would make it valuable in the arts if it could be obtained in large quantities.

The earliest account of *Amyris maritima* appears to be that of Catesby, who published in his *Natural History of Carolina* a very good figure of the small-leaved littoral variety.[1] It was first noticed in Florida on the east coast in 1821 by Mr. N. A. Ware,[2] and was collected later on Key West by Dr. J. L. Blodgett.

[1] *Frutex trifolius resinosus; floribus tetra-petalis albis racemosis*, ii. 33, t. 33.

Elemifera foliis ternatis, Linnæus, *Hort. Cliff.* 486.

Amyris; fruticosus minor, foliis orbiculatis venosis, pinnato-ternatis; racemis terminatricibus, Browne, *Nat. Hist. Jam.* 209.

[2] Nathaniel A. Ware (about 1789–1853); a native of Massachusetts, and a teacher and lawyer in South Carolina and then at Natchez, Mississippi, where he became a major of militia and the secretary of the territorial government, and where he acquired a large fortune by the purchase of lands. He traveled extensively in the southern states, and was known for his attainments in geography and the natural sciences, and as the author of works on the Pestalozzian system of education, on the federal constitution, and on political economy. His services to science are commemorated in the genus *Warea* established by Nuttall in his honor.

EXPLANATION OF THE PLATE.

PLATE XXXVI. AMYRIS MARITIMA.

1. A flowering branch, natural size.
2. Diagram of a flower.
3. A flower, enlarged.
4. Vertical section of a flower cut transversely, enlarged.
5. A flower, the petals and stamens removed, enlarged.
6. A fruiting branch, natural size.
7. Vertical section of a fruit, enlarged.
8. Cross section of a fruit, enlarged.
9. Embryo, much magnified.

C. E. Faxon del. Picart fr. sc.

AMYRIS MARITIMA, Jacq.

A. Riocreux direx.t Imp. R. Taneur, Paris.

CANOTIA.

FLOWERS perfect; calyx 5-lobed, imbricated in æstivation, persistent; petals 5, imbricated in æstivation, hypogynous. Fruit, a woody 5-celled capsule.

Canotia, Torrey, *Pacific R. R. Rep.* iv. 68. — Bentham & Hooker, *Gen.* i. 616. — Baillon, *Adansonia*, x. 18; *Hist. Pl.* vi. 42; *Dict.* i. 612. — Gray, *Proc. Am. Acad.* xii. 159. — Maximowicz, *Act. Hort. St. Pétersbourg*, vi. 256.

A glabrous leafless tree, with light brown deeply furrowed bark. Branches stout, terete, alternate, terminated in rigid spines, pale green, striate, their bases and those of the peduncles surrounded with black triangular persistent cushion-like processes, with a minutely papillose surface having the appearance of appressed scales. Flowers three to seven together in short-stemmed fascicles or corymbs near the extremities of the branches, from the axils of minute ovate subulate bracts. Pedicels slender, spreading, jointed below the middle. Calyx minute, the lobes much shorter than the oblong obtuse sessile white petals reflexed at maturity above the middle, deciduous. Stamens five, hypogynous, opposite the lobes of the calyx; filaments awl-shaped, rather shorter than the petals, persistent on the fruit; anthers oblong, cordate, introrse, minutely apiculate, attached below the middle, grooved on the back, two-celled, the cells opening longitudinally. Ovary raised upon and confluent with a fleshy slightly ten-angled gynophore, papillose-glandular on the surface, five-celled, the cells opposite the petals, terminated in a fleshy elongated style; stigma slightly five-lobed; ovules six in each cell, inserted in two ranks on its inner angle, sub-horizontal; the micropyle inferior. Capsule terete, oblong, tapering at each end, crowned with a subulate persistent style, five-celled, septicidally five-valved, the valves two-lobed at the apex; epicarp thin, fleshy; endocarp woody. Seed solitary or in pairs, ascending, subovate, flattened; testa subcoriaceous, papillate, produced below into a broad subfalcate membranaceous wing. Embryo surrounded by thin fleshy albumen, erect; cotyledons oval, compressed; the radicle very short, inferior.

The wood of Canotia is heavy, hard, and close-grained, with numerous thin rather obscure medullary rays. It is light brown with thick lighter colored sapwood. The specific gravity of the absolutely dry wood is 0.6885, a cubic foot weighing 42.91 pounds.

The generic name Canotia,[1] given to this tree by Torrey, is the name by which it was known to the Mexicans of Arizona at the time of its discovery. The genus is represented by a single species.

[1] Canotia was compared by Torrey, who knew the fruit only with its persistent calyx and filaments, to Euchryphia, which Lindley, following Choisy, had referred to *Hypericaceæ*. Bentham & Hooker, to whom the flowers were also unknown, placed it with Euchryphia in *Rosaceæ*. Baillon referred the genus to *Celastraceæ*, and finally Gray, relying on the structure of the gynobase and the faint traces of Rutaceous oil-glands in the bracts of the inflorescence, the sepals and petals, placed it in *Rutaceæ* in spite of the inferior radicle. (*Proc. Am. Acad.* xii. 160.)

CANOTIA HOLACANTHA.

Canotia holacantha, Torrey, *Pacific R. R. Rep.* iv. 68. — Gray, *Ives' Rep.* 15; *Proc. Am. Acad.* xii. 160. — Brewer & Watson, *Bot. Cal.* i. 190. — Rothrock, *Wheeler's Rep.* 24, 81, t. i. — Rusby, *Bull. Torrey Bot. Club*, ix. 106. — Sargent, *Forest Trees N. Am.* 10*th Census U. S.* ix. 32.
Koeberlinia (?), Engelmann, *Emory's Rep.* 158, f. 14.

Canotia holacantha is a small shrub-like tree, sometimes twenty to thirty feet high, with a short stout trunk rarely a foot in diameter, or often a low spreading shrub. It grows on the dry gravelly mesas of the Arizona foothills, from the White-mountain region to the valley of Bill Williams Fork in the northwestern part of the territory, and on Providence Mountain in southern California.[1]

Canotia holacantha was discovered in January, 1854, on the hills above White Cliff Creek, a small tributary of Bill Williams Fork, by Dr. J. M. Bigelow,[2] botanist of the expedition under Lieutenant A. W. Whipple, United States army, to explore a route for a railroad from the Mississippi River to the Pacific Ocean near the thirty-fifth parallel.

[1] Brewer & Watson, *Bot. Cal.*, *l. c.*

[2] John Milton Bigelow (1804–1878) was born in Middlebury, Vermont. His family moved to Ohio in 1815, and in 1832 the son graduated from the Medical College of Ohio. He established himself in the practice of his profession in Lancaster, Ohio, and received in 1850 the appointment of surgeon of the Mexican Boundary Commission, and three years later, on the completion of the boundary survey, that of surgeon and botanist of the government expedition organized to explore, under command of Lieutenant Whipple, a route along the thirty-fifth parallel for a railroad from the Mississippi River to the Pacific Ocean. In 1860 Dr. Bigelow made his home in Detroit, where later he was appointed surgeon of the Marine Hospital, and Professor of Medical Botany and Materia Medica in the Medical College. The list of Dr. Bigelow's botanical contributions includes a paper on the medical plants of Ohio, published in 1849; important papers on the botanical character of the country traversed by Lieutenant Whipple's expedition, and a description of its forest trees and of some of the valuable and remarkable trees of California, published in the fourth volume of the *Pacific Railroad Reports;* a number of papers on the medicinal properties of plants, written during the last years of his life, and published in the *Detroit Journal of Medicine and Pharmacy.*

EXPLANATION OF THE PLATE.

PLATE XXXVII. CANOTIA HOLACANTHA.

1. A flowering branch, natural size.
2. Diagram of a flower.
3. A flower, enlarged.
4. Vertical section of a flower, enlarged.
5. Anterior and posterior views of a stamen, enlarged.
6. A fruiting branch, natural size.
7. Vertical section of a fruit, natural size.
8. A seed, enlarged.
9. Vertical section of a seed, enlarged.
10. An embryo, much enlarged.

C.E. Faxon del. Picart fr. sc.

CANOTIA HOLACANTHA, Torr.

A. Riocreux direx.t Imp. R. Taneur, Paris.

SIMARUBA.

FLOWERS diœcious; calyx 5-lobed, imbricated in æstivation; petals 5, imbricated in æstivation, hypogynous. Fruit composed of 1 to 5 drupes. Leaves alternate, abruptly pinnate.

Simaruba, Aublet, *Pl. Guian.* ii. 859. — Meisner, *Gen.* 65. — Endlicher, *Gen.* 1143. — Bentham & Hooker, *Gen.* i. 309. — Baillon, *Hist. Pl.* iv. 490.

Trees, with bitter resinous juice and tonic properties. Leaves persistent, long-petioled, destitute of stipules, abruptly pinnate; leaflets usually alternate, conduplicate in vernation, entire, coriaceous, glabrous or slightly puberulous on the lower surface, feather-veined. Flowers subcymose in elongated widely branched axillary and terminal panicles. Disk cup-shaped, depressed in the sterile flower, pubescent. Stamens ten, inserted at the base of the disk, as long as the petals; reduced in the fertile flower to minute scales; filaments free, filiform, thickened towards the base, inserted on the back of a minute ciliate scale; anthers oblong, slightly emarginate, introrse, attached on the back below the middle, two-celled, the cells opening longitudinally. Ovary sessile on the disk, deeply five-lobed, the lobes opposite the petals, five-celled; rudimentary, lobulate, minute or wanting in the sterile flower; styles united into a short column crowned by a three to five-lobed spreading stigma; ovules solitary in the cells, suspended from their inner angle towards the apex, anatropous; raphe ventral; micropyle superior. Drupes sessile, spreading; sarcocarp thin, fleshy; putamen crustaceous. Seed inverse, exalbuminous; testa membranaceous; cotyledons plano-convex, fleshy; the radicle very short, partly included between the cotyledons, superior.

The genus Simaruba, of which four species are known, is confined to tropical America. *Simaruba glauca*, a widely distributed tree in the West Indies, and in Central and South America, extends to the coast of southern Florida, the most northern station of the genus. *Simaruba amara*,[1] the type of the genus, is a native of Guiana and the islands of the Caribbean Sea. *Simaruba versicolor*[2] inhabits Brazil and Guatemala, and *Simaruba Tulæ*[3] the island of Porto Rico.

Simaruba, in common with several other genera of its family, contains a small amount of resin, a volatile oil, and an exceedingly bitter principle, quassin, which give it tonic properties and make it digestible. The bark of the roots is most active, although that of the trunk and branches, like the wood of all the species, is bitter, aromatic, and tonic. The bark of the root of *S. amara* furnishes a valuable tonic; it is purgative and emetic, and is used in Guiana in the treatment of fevers and diarrhœa.[4] Simaruba bark was first sent to Europe in 1713,[5] where it was at one time used in considerable quantities, and is still occasionally met with in commerce in the form of long narrow quills.[6] The bark of the root of *S. glauca* possesses the same properties, and is occasionally used for the same purposes.[7] The

[1] Aublet, *Pl. Guian.* ii. 860, t. 331, 332. — A. de Jussieu, *Mém. Mus.* xii. 514, t. 27, f. 44. — Grisebach, *Fl. Brit. W. Ind.* 139. — Hemsley, *Bot. Biol. Am. Cent.* i. 173.

[2] St. Hilaire, *Pl. Usuelles Brasil.* 1, t. 5; *Fl. Bras. Merid.* i. 70. — Engler, *Martius Fl. Brasil.* xii. 2, 226. — Hemsley, *Bot. Biol. Am. Cent.* i. 173.

[3] Urban, *Jahrbuch König. Bot. Gart. Berlin*, iv. 245.

[4] Aublet, *Pl. Guian.* ii. 860. — Lindley, *Fl. Med.* 208.

[5] Woodville, *Med. Bot.* ii. 211, t. 76.

[6] Stillé & Maisch, *Nat. Dispens.* ed. 2, 1295. — Guibourt, *Hist. Drog.* ed. 7, iii. 570.

[7] Macfadyen, *Fl. Jam.* 198. — Stillé & Maisch, *l. c.*

bark of *S. versicolor* is valued by the Brazilians for the treatment of fevers, and as a remedy for snake bites. The wood of this species is reputed to be so bitter that insects will not attack it.[1]

The generic name Simaruba is formed from *Simarouba*, the Carib name of the species described by Aublet.[2]

[1] Lindley, *Fl. Med.* 208.

[2] The generic name was written Simarouba by Aublet, and this form was used by the early authors who mentioned the tree. (*Euonymus fructu nigro tetragono vulgo Simarouba*, Barrère, *France Equinoxiale*, 50.— *Le Simarouba vel Bois amer.* Des Marchais, *Voyages en Guinée et à Cayenne*, ii. 124.) Simaruba appears to have been first used by Linnæus in the *Materia Medica* (188) to designate a species of Bursera, and again in the first edition of the *Species Plantarum*, as the specific name of his *Pistacia Simaruba*, the Bursera of Jacquin. Endlicher and all subsequent authors have followed the Linnæan spelling of the word.

SIMARUBA GLAUCA.

Paradise Tree.

LEAFLETS glabrous, obtuse or minutely mucronate. Petals fleshy.

Simaruba glauca, De Candolle, *Diss. Ann. Mus.* xvii. 323; *Prodr.* i. 733. — Humboldt, Bonpland & Kunth, *Nov. Gen. et Spec.* vi. 16. — Descourtilz, *Fl. Med. Antil.* i. 66, t. 14. — Planchon, *Lond. Jour. Bot.* v. 567. — Nuttall, *Sylva*, iii. 20, t. 87. —Walpers, *Ann.* i. 164. — Grisebach, *Fl. Brit. W. Ind.* 139. — Chapman, *Fl.* 67. — Planchon & Triana, *Ann. Sci. Nat.* ser. 5, xv. 357. — Engler, *Martius Fl. Brasil.* xii. 2, 223. — Hemsley, *Bot. Biol. Am. Cent.* i. 173. — Sargent, *Forest Trees N. Am.* 10*th Census U. S.* ix. 32.

S. officinalis, Macfadyen, *Fl. Jam.* 198 (not De Candolle).

S. medicinalis, Endlicher, *Medz. Pf.* 525. — Berg, *Handb.* i. 373. — Berg & Schmidt, *Off. Gen.* ii. t. 13.

A low round-headed tree, growing occasionally in Florida to the height of fifty feet, with a straight trunk eighteen or twenty inches in diameter, and slender spreading branches. The bark of the trunk is a half to three quarters of an inch thick, its light red-brown surface broken into broad thick appressed scales. The bark of the stout branchlets is pale green and glabrous when they first appear; it turns light brown before the end of the summer, and is rugose and conspicuously marked during the second season with the large oval scars left by the falling of the leaves. The leaves are six to ten inches long, on stout petioles two or three inches in length and dilated at the base, and are generally composed of six pairs of leaflets. These are opposite or alternate, ovate, obovate or oval, two to three inches in length, and an inch or an inch and a half wide, with revolute margins, a prominent midrib, and remote narrow conspicuous primary veins; they are rounded or slightly mucronate at the apex, and are often oblique at the base, which is contracted into a short stout petiolule a quarter to a third of an inch in length; they are thin, membranaceous and dark red when they first unfold, but soon become coriaceous, dark green and very lustrous above, and pale and glaucous on the lower surface. The panicles of flowers are twelve to eighteen inches long and eighteen to twenty-four inches broad, with stout pale glaucous stems, and spreading branches from the axils of small acute scarious deciduous bracts. The inflorescence of the pistillate plant is often larger and less compact than that of the staminate plant. The panicles appear in Florida early in April or at the time the trees begin their annual growth, the flowers opening irregularly, a few at a time, and continuing to appear during several weeks. They are borne on short stout club-shaped glaucous pedicels, and are an eighth to a quarter of an inch long. The oval or often acute pale yellow petals are four or five times longer than the glaucous calyx. The fertilized ovaries grow rapidly, and the fruit is almost fully grown by the end of April, when it is bright scarlet, nearly an inch long, ovate or sometimes falcate, and slightly angled on the ventral suture. According to Macfadyen it is dark purple when fully ripe. The outer coating of the seed is papillose and orange-brown.

Simaruba glauca grows in Florida from Cape Canaveral on the west coast to the southern keys and the neighborhood of Bay Biscayne. It has been found in Cuba and Jamaica, in Nicaragua,[1] and in Brazil. In Florida, where it is nowhere common, it reaches its best development on the rich hummock lands near the shores of Bay Biscayne.

The wood of *Simaruba glauca* is light, soft, and close-grained, possessing little strength or value. It contains many large scattered open ducts, and thin remote medullary rays. The thick sapwood is rather darker colored than the light brown heartwood. The specific gravity of the absolutely dry wood is 0.4136, a cubic foot weighing 25.78 pounds.

[1] By Charles Wright, on the North Pacific Exploring Expedition.

Simaruba glauca was first distinguished by Humboldt, who found it near the port of La Trinidad on the island of Cuba. It was discovered in Florida by Dr. J. L. Blodgett.

The Paradise-tree, as *Simaruba glauca*, perhaps on account of its beauty, is sometimes called by the inhabitants of Key West, is the handsomest of the tropical trees found in southern Florida. It is a desirable ornamental tree to cultivate in the gardens of the tropics for its excellent habit, brilliant and ample foliage, and bright-colored fruit.

EXPLANATION OF THE PLATES.

PLATE XXXVIII. SIMARUBA GLAUCA.

1. A staminate inflorescence, natural size.
2. A staminate flower, enlarged.
3. Vertical section of a staminate flower, enlarged.
4. Anterior and posterior views of a stamen, enlarged.

PLATE XXXIX. SIMARUBA GLAUCA.

1. A pistillate inflorescence, natural size.
2. Diagram of a pistillate flower.
3. Vertical section of a pistillate flower, enlarged.
4. An ovary, enlarged.
5. A panicle of fruit, natural size.
6. Vertical section of a fruit, enlarged.
7. Cross section of a fruit, enlarged.
8. An embryo, much enlarged.

C.E. Faxon del.

Picart fr. sc.

SIMARUBA GLAUCA, DC.

A. Riocreux direx.t

Imp. R. Taneur, Paris.

C.E. Faxon del.

Picart fr. sc.

SIMARUBA GLAUCA, DC.

A. Riocreux direx.t

Imp. R. Taneur, Paris.

KOEBERLINIA.

FLOWERS perfect; sepals 4, imbricated in æstivation, deciduous; petals 4, convolute in æstivation, hypogynous; disk 0. Fruit, a 2-celled berry. Leaves bract-like, minute, early-deciduous.

Koeberlinia, Zuccarini, *Pl. Hort. et Herb. Monac.* i. 358 (*Münchner Denkschrift*, 1832). — Meisner, *Gen.* 66. — Endlicher, *Gen.* 1084. — Gray, *Pl. Wright.* i. 30 (*Smithsonian Contrib.* iii. 66). — Bentham & Hooker, *Gen.* i. 315. — Baillon, *Hist. Pl.* iv. 503.

An intricately branched, almost leafless tree or shrub, with thin red-brown scaly bark. Branches stout, alternate, glabrous, covered with pale green bark, and terminating in sharp rigid straight or slightly curved spines. Leaves minute, alternate, narrowly obovate, rounded at the apex, deciduous. Flowers minute, in short umbel-like lateral racemes produced below the ends of the branches. Pedicels, from the axils of minute scarious deciduous bracts, slender, club-shaped, puberulous. Calyx composed of three or four minute sepals with scarious margins, much shorter than the obovate-oblong subunguiculate white petals. Stamens eight, free, hypogynous, as long as the petals; filaments thickened in the middle, subulate at the two extremities; anthers oval, attached on the back near the base, two-celled, the cells opening longitudinally. Ovary ovoid, two-celled, contracted at the base into a short stalk, and above into a short simple subulate style; stigma terminal, obtuse, slightly emarginate; ovules numerous, adnate in several series to the fleshy placenta, horizontal or dependent, anatropous. Fruit black at maturity, subglobose, tipped with the remnants of the pointed style, two-celled; sarcocarp thin and fleshy; the cells one to two-seeded by abortion. Seed vertical, circinate-cochleate; testa crustaceous, slightly rugose, striate; albumen thin. Embryo annular, filling the tumid inner seed-coat; cotyledons semi-terete; the radicle ascending.

The wood of Koeberlinia is very hard, heavy, and close-grained; it contains numerous small ducts in narrow lines faintly marking the layers of annual growth, and many thin medullary rays. It is dark brown, somewhat streaked with orange, turning almost black with exposure, with thin pale yellow or nearly white sapwood composed of twelve to fifteen layers of annual growth. The specific gravity of the absolutely dry wood is 1.1201, a cubic foot weighing 69.80 pounds.

The genus Koeberlinia was named by Zuccarini in honor of C. L. Koeberlin.[1] It is represented by a single species.

KOEBERLINIA SPINOSA.

Koeberlinia spinosa, Zuccarini, *Pl. Hort. et Herb. Monac.* i. 359 (*Münchner Denkschrift*, 1832). — Bentham, *Pl. Hartweg.* 35. — Walpers, *Rep.* i. 258. — Engelmann, *Wislizenus Rep.* 29; *Emory's Rep.* 158, f. 13. — Gray, *Pl. Wright.* i. 30; ii. 26 (*Smithsonian Contrib.* iii. v.). — Torrey, *Bot. Mex. Bound. Surv.* 42. — Hemsley, *Bot. Biol. Am. Cent.* i. 175. — Sargent, *Garden and Forest*, ii. 352.

Koeberlinia spinosa is a small shrub-like tree, rarely twenty or twenty-five feet in height, with a short stout trunk sometimes six or eight feet long and a foot in diameter; or more often a low branching shrub forming impenetrable thickets, often of considerable extent. It grows on dry gravelly mesas

[1] "Diximus hoc genus in honorem L. Koeberlin, amici candidissimi, botanici indefessi, de patria flora optime meriti," Zuccarini, *l. c.* 359.

from the valley of the lower Rio Grande in Texas southward through northern Mexico to the neighborhood of San Luis Potosí, and to the plains near the Altar River in Sonora.[1]

Koeberlinia spinosa was discovered in Mexico by Karwinsky,[2] a Bavarian naturalist, about 1830, and in Texas by Mr. Charles Wright[3] in 1848.

[1] C. G. Pringle.

[2] Wilhelm Freiherr Karwinsky von Karwin (1778–1854) visited Mexico in 1826, remaining for five years in the province of Oaxaca, and again in 1840. He made many interesting discoveries, and introduced many plants, especially of the Cactus family, into European gardens. *Karwinskia*, a genus of *Rhamnaceæ*, established by Zuccarini, and represented by half a dozen shrubs of Mexico, Texas, and California, preserves his memory.

[3] Charles Wright (1811–1886); born at Wethersfield, Connecticut, a graduate of Yale College in 1835, and one of the most assiduous, industrious, and successful botanical collectors. Wright moved to Texas in 1837, establishing himself there as a land-surveyor and school-teacher, but devoting much time to botanical study and collecting. He visited the Rio Grande in 1847, and in 1849 accompanied a small body of United States troops on an expedition from San Antonio to El Paso. The discoveries he made on this journey were published by Gray in his *Plantæ Wrightianæ*. Two years later he was attached as botanist to one of the parties of the United States and Mexican Boundary Survey. In 1852 he was appointed botanist of the North Pacific Exploring Expedition, the duties of this position engaging him during nearly three years; while from 1856 to 1865 he was actively employed in the botanical exploration of the island of Cuba. In 1871 he undertook his last long journey, going to San Domingo as a member of a government exploring party. Wright discovered large numbers of new plants in the different parts of the world which he visited, and none of his contemporaries did more to make known the peculiar flora of the region along the southern boundary of the United States. *Carlowrightia*, an Acanthaceous genus of his discovery established by Gray, commemorates his services to science.

EXPLANATION OF THE PLATE.

Plate XL. Koeberlinia spinosa.

1. A branch showing the new growth and leaves, natural size.
2. A flowering branch, natural size.
3. A leaf, enlarged.
4. Diagram of a flower.
5. A flower, enlarged.
6. Vertical section of a flower, enlarged.
7. A fruiting branch, natural size.
8. Vertical section of a fruit, showing the seed, enlarged..
9. Cross section of a fruit, enlarged.
10. Vertical section of a seed, enlarged.
11. An embryo, much enlarged.

C. E. Faxon del. Picart fr. sc.

KOEBERLINIA SPINOSA, Zucc.

A. Riocreux direx.t Imp. R. Taneur, Paris.

BURSERA.

FLOWERS polygamous; calyx 4 or 5-parted, the lobes imbricated in æstivation; petals 4 or 5, imbricated in æstivation. Fruit, a drupe with valvate epicarp. Leaves compound, alternate.

Bursera, Jacquin, *Stirp. Am.* 94. — Linnæus, *Gen.* ed. 6, 174. — A. L. de Jussieu, *Gen.* 372. — Meisner, *Gen.* 77. — Endlicher, *Gen.* 1136. — Bentham & Hooker, *Gen.* i. 324 (excl. *Marignia* and *Icica*.). — Baillon, *Hist. Pl.* v. 309 (excl. *Protium*, *Marignia*, and *Icica*). — Engler, *De Candolle Monogr. Phaner.* iv. 36.

Elaphrium, Jacquin, *Stirp. Am.* i. 105, t. 71. — Meisner, *Gen.* 77. — Endlicher, *Gen.* 1136.

Trees, with balsamic resinous juices. Leaves destitute of stipules, membranaceous, often confined to the ends of the branches, unequally pinnate, or three or rarely one-foliolate; the rhachis terete, sometimes winged; leaflets opposite, petiolulate, entire or subserrate. Flowers small the pedicels fascicled or rarely solitary, in short elongated lateral simple or branched panicles. Calyx minute, membranaceous, the lobes much shorter than the ovate-oblong petals inserted on the base of the annular crenate disk, and reflexed at maturity above the middle. Stamens eight to ten, inserted on the base of the disk; filaments free, subulate; anthers oblong, attached on the back above the base, introrse, two-celled, the cells opening longitudinally; usually effete in the pistillate flower. Ovary free, sessile, ovoid, three-celled; rudimentary in the staminate flower. Style short; stigma capitate, obtuse, three-lobed; ovules two in each cell, suspended below the apex from the central angle, collateral, anatropous; micropyle superior; raphe ventral. Drupe globose or oblong-oblique, indistinctly three-angled; epicarp coriaceo-carnose, two or three-valved; nutlets one to three, usually solitary, or when more than one, closely united, adnate to a persistent fleshy axis, one-celled, one-seeded, covered with a thin membranaceous coat. Seed ovoid, destitute of albumen; testa membranaceous; hilum ventral, below the apex. Embryo straight; cotyledons foliaceous, contortuplicate; radicle short, superior.

Bursera is Mexican, Central and South American, and West Indian, with a single species reaching the shores of southern Florida. About forty species[1] are described, of which more than half belong to the warmer regions of Mexico.[2] Four or five species grow in the West Indies,[3] and eight or nine are scattered over Central[4] and South America from Guatemala to Venezuela,[5] Brazil,[6] and Peru.[7] The plants of this genus have few properties useful to man. It was established by Jacquin, and named in honor of Joachim Burser,[8] a German botanist and physician of the seventeenth century.

[1] De Candolle, *Prodr.* ii. 78. — Engler, *De Candolle Monogr. Phaner.* iv. 37.

[2] Humboldt, Bonpland & Kunth, *Nov. Gen. et Spec.* vii. 20, t. 611, 612. — Schlechtendal, *Linnæa*, xvi. 523; xvii. 245, 625. — Bentham, *Bot. Sulphur*, ii. t. 8. — Gray, *Proc. Am. Acad.* v. 155; xvii. 230. — Hemsley, *Bot. Biol. Am. Cent.* i. 177. — Watson, *Proc. Am. Acad.* xxi. 421; xxii. 402, 469; xxiv. 43. — Brandegee, *Proc. Cal. Acad.* ser. 2, ii. 138.

[3] Richard, *Fl. Cub.* 389. — Grisebach, *Fl. Brit. W. Ind.* 173; *Cat. Pl. Cub.* 65.

[4] Triana & Planchon, *Ann. Sci. Nat.* ser. 5, xiv. 302.

[5] Engler, *De Candolle Monogr. Phaner.* 41.

[6] Engler, *Martius Fl. Brasil.* xii. 2, 251.

[7] Triana & Planchon, *l. c.* 303.

[8] Joachim Burser (1593–1649); a native of Camentz in Upper Lusatia, a disciple of Kaspar Bauhin, the botanist of Basel, and himself a distinguished physician and botanist, and professor of physic and medicine in the academy of Soröe in Denmark. The catalogue of his herbarium, gathered in numerous journeys, especially in the Alps and Pyrenees, and preserved in the University of Upsala, was prepared by Peter Martin, and published in 1724 in the Transactions of the Academy of Upsala, under the title of *Catalogus Plantarum Novarum Joachini Burseri.*

BURSERA SIMARUBA.

Gumbo Limbo. West Indian Birch.

SEPALS and petals 5. Fruit 1 to 2-seeded. Leaflets green on both surfaces, prominently reticulate-veined below.

Bursera Simaruba, Sargent, *Garden and Forest*, iii. 260.
Pistacia Simaruba, Linnæus, *Spec.* 1026.
Bursera gummifera, Jacquin, *Stirp. Am.* 94, t. 65. — Linnæus, *Spec.* ed. 2, 471. — Lamarck, *Ill.* ii. 767, t. 256. — Willdenow, *Spec.* iv. 1119. — Titford, *Hort. Bot. Am.* 107. — De Candolle, *Prodr.* ii. 78. — Descourtilz, *Fl. Med. Antil.* ii. 117, t. 97. — Spach, *Hist. Veg.* ii. 239. — Macfadyen, *Fl. Jam.* 229. — Nuttall, *Sylva*, ii. 117, t. 79. — Richard, *Fl. Cub.* 390. — Grisebach, *Fl. Brit. W. Ind.* 173. — Chapman, *Fl.* 68. — Marchand, *Organ. Burséracées*, 13. — Triana & Planchon, *Ann. Sci. Nat.* ser. 5, xv. 302. — Hemsley, *Bot. Biol. Am. Cent.* i. 177. — Engler, *De Candolle Monogr. Phaner.* iv. 39. — Sargent, *Forest Trees N. Am.* 10*th Census U. S.* ix. 32.
Elaphrium integerrimum, Tulasne, *Ann. Sci. Nat.* ser. 3, vi. 369.

A glabrous tree, fifty or sixty feet in height, with a trunk two and a half to three feet in diameter, and stout massive primary branches spreading nearly at right angles. The bark of the trunk and principal branches is an inch thick, marked with glandular dots, and separating freely into thin papery scales which are bright red-brown, while the surface, which is exposed when they fall, is dark brown or gray. The branchlets are stout, terete, light gray during their first season, becoming reddish brown during the second year, covered with lenticular spots, and conspicuously marked with yellow leaf-scars. The winter-buds are short, round, obtuse, and have broadly ovate dark-red scales with slightly scarious margins. The leaves are confined to the ends of the branchlets, and are usually composed of five leaflets, although they sometimes have three or seven; they are six to eight inches in length and four to eight inches broad, with a long slender petiole; they fall in the early winter, or occasionally remain on the branches until the beginning of the new growth in the spring. The leaflets, which are slightly coriaceous at maturity, are oblong, ovate, oblique at the base, and contracted at the apex into a long or short point; they are two and a half to three inches in length, and one and a half to two inches broad, and are borne on stout petiolules, often half an inch long. The flowers appear before the leaves or while they are unfolding. They are produced in slender raceme-like panicles, those of the sterile plants being four or five inches long, or nearly twice the length of those of the fertile plants. The slender pedicels, which appear two to five together in lateral fascicles, are a third to half an inch long, and two or three times longer than the flower-buds. The petals are ovate-lanceolate, acute, with revolute margins, and are four times as long as the slender acute lobes of the calyx. The stamens of the sterile flowers are as long as the petals, and in the pistillate flowers not more than half as long with smaller, often effete anthers. The fruit, which is produced in short raceme-like clusters, is a quarter to a third of an inch long, three-angled, with a thick dark red leathery outer coating separating readily into three broad ovate valves. It contains one or rarely two bony triangular nutlets rounded at the base, pointed at the other end, and covered with a thin membranaceous light pink coat which separates from them easily when the fruit is ripe.

Bursera Simaruba grows in Florida from Cape Canaveral to the southern keys, and on the west coast on the Caloosa River and the shores of Caximbas Bay. It is found on most of the West Indian islands, in tropical Mexico, in Guatemala, New Grenada, and Venezuela. It is one of the largest and most common of the south Florida trees, and the only one that sheds its foliage during the autumn and winter.

The wood of *Bursera Simaruba* is spongy, very light, exceedingly soft and weak, and contains

many numerous open ducts and thin medullary rays. It is light brown with a thick sapwood of the same color, and soon becomes discolored by decay. The specific gravity of the absolutely dry wood is 0.3003, a cubic foot of the dry wood weighing 18.71 pounds. The wood of only three other North American trees is lighter than that of *Bursera Simaruba*, which decays so rapidly that it is useless in the arts and even for fuel.[1] Pieces of the trunk or the large branches cut and set in the ground quickly develop roots and grow rapidly into large trees, a peculiarity which renders it valuable in making hedges or fences.[2] The aromatic resin obtained from incisions cut in the trunk of this tree was formerly used under the name of Caranna in the treatment of gout,[3] and in the West Indies it is manufactured into varnish. An infusion of the leaves is sometimes used in Florida as a substitute for tea.

Bursera Simaruba was one of the first American trees which attracted the attention of Europeans, and many of the early authors mention it. It was noticed by Oviedo y Valdes;[4] Paul Hermann[5] described it in 1689; and it was first figured by Plukenet.[6]

Bursera Simaruba, according to Aiton, was cultivated in the gardens of Hampton Court palace, near London, in 1690.[7]

[1] "Fromage de Holland a cause que son bois est le plus tendre de tout les bois qui soient dans les isles," Du Tertre, *Histoire Générale des Isles de St. Christophe*, etc. 220.

[2] "The Branches of this Tree being staked into the Earth, will grow; and, I have known a Branch of it, tho' stripped of its Leaves, and exposed to Wind and Weather (as Part of an Arbour for a Grape-vine), which, in this Situation, budded and put forth young Shoots, & Leaves." (Griffith Hughes, *Natural History of the Barbadoes*, 145.)

[3] Henry Watts, *Dict. Chemistry*, i. 749. — Guibourt, *Hist. Drog.* ed. 7, iii. 525, f. 749.

[4] *Hist. Gen. Nat. Ind.* lib. 9, cap. 10.

[5] *Terebinthus Americ. polyphylla, Palamalatta dicta, Parad. Bat. Prodr.* 379. — Plukenet, *Phyt.* t. 228, f. 6.

[6] *Betula arbor Americana, seminibus Lithospermi frumentacei æmulis. Birch-tree Barbadensibus dicta, Phyt.* t. 151, f. 1.

Terebinthus major, betulæ cortice, fructu triangulari, Sloane, *Cat. Jam.* 167; *Hist. Jam.* ii. 89, t. 199, f. 1, 2. — Catesby, *Nat. Hist. Car.* i. 30, t. 30.

Terebinthus foliis cordato-ovatis pinnatis, cortice levi rufescente floribus masculinis spicatis, Browne, *Nat. Hist. Jam.* 345.

[7] *Hort. Kew.* i. 479.

EXPLANATION OF THE PLATES.

PLATE XLI. BURSERA SIMARUBA.

1. A flowering branch of staminate flowers, natural size.
2. A flowering branch of pistillate flowers, natural size.
3. A flower-bud, enlarged.
4. A staminate flower, enlarged.
5. Vertical section of a staminate flower, enlarged.
6. Anterior and posterior views of a stamen, enlarged.
7. A pistillate flower, enlarged.
8. Vertical section of a pistillate flower, enlarged.
9. Diagram of a pistillate flower.

PLATE XLII. BURSERA SIMARUBA.

1. A fruiting branch, natural size.
2. A fruit, the valves partly open, natural size.
3. Vertical section of a drupe, enlarged.
4. A nutlet, enlarged.
5. Vertical section of a nutlet, enlarged.
6. An embryo, much enlarged.
7. An embryo, the cotyledons displayed, much enlarged.

C. E. Faxon del. Picart fr. sc.

BURSERA SIMARUBA, Sarg.

A. Riocreux direx.t Imp. R. Taneur, Paris.

C.F. Faxon del.

Picart fr. sc.

BURSERA SIMARUBA, Sarg.

A. Riocreux direx.t

Imp. R. Taneur, Paris.

SWIETENIA.

FLOWERS perfect; calyx 5-lobed, the lobes contorted in æstivation; petals 5, convolute in æstivation; filaments united into an urn-shaped tube. Fruit, a 5-celled capsule. Leaves alternate, abruptly pinnate.

Swietenia, Jacquin, *Stirp. Am.* 127. — Linnæus, *Gen.* ed. 6, 209. — A. L. de Jussieu, *Gen.* 266. — Meisner, *Gen.* 47. — Endlicher, *Gen.* i. 1053. — Bentham & Hooker, *Gen.* i. 338. — Baillon, *Hist. Pl.* v. 504.

Mahagoni, Adanson, *Fam. Pl.* ii. 343 (excl. syn. *Guidonia*, Plumier).

Noble trees, with heavy dark red wood. Leaves glabrous, destitute of stipules, long-petioled; leaflets opposite, petiolulate, usually oblique at the base. Flowers small, in axillary or subterminal panicles produced near the ends of the branches. Pedicels slender, bibracteolate near the middle. Calyx minute, much shorter than the spreading petals. Staminal tube connate with the petals, ten-lobed, the lobes convolute in æstivation; anthers ten, fixed by the back below the sinuses of the staminal tube, included, introrse, two-celled, the cells opening longitudinally. Ovary free, sessile on the annular disk, ovoid, five-celled, the cells opposite the petals; style erect, exserted from the tube of stamens, dilated into a discoid five-rayed stigma. Ovules many in each cell, suspended from the central axis, semi-anatropous; raphe ventral; micropyle superior. Capsule five-valved, septicidally dehiscent from the base, the valves bilamellate, separating from a persistent five-angled axis thickened towards the apex and five-winged towards the base. Seeds suspended from near the summit of the axis, imbricate in two ranks, compressed, emarginate, produced above into a long membranaceous wing with the hilum in its apex and transversed by the raphe; chalaza lateral. Embryo transverse; cotyledons conferruminate with each other and with the thin fleshy albumen; radicle short, papillæform, opposite the chalaza.

Swietenia, of which three species are recognized, is tropical American and west-tropical African. *Swietenia Mahagoni*, the type of the genus and one of the most valuable timber trees known, is distributed from south Florida, the most northern station of the genus, to Mexico, Central America, and Peru. *Swietenia humilis*,[1] perhaps a form of the last species, is found on the Pacific coast of Mexico. *Swietenia Angolensis*,[2] a large deciduous tree, inhabits the mountain forests of central Quitta in west-tropical Africa.[3]

The genus was named by Jacquin in honor of Baron von Swieten, a distinguished physician of the eighteenth century.[4]

[1] Zuccarini, *Pl. Hort. et Herb. Monac.* ii. 355, t. 7 (*Münchner Denkschrift*). — C. de Candolle, *Monogr. Phaner.* i. 723. — Hemsley, *Bot. Biol. Am. Cent.* i. 183.

[2] Welwitsch, "Apont. *Ann. do Conselh.* 561." — C. de Candolle, *Monogr. Phaner.* i. 724.

[3] A fourth species, *Swietenia macrophylla*, King (*Hooker Icon.* xvi. t. 1550), is described. It was raised several years ago in the Calcutta Botanic Garden from seeds said to have been sent from Central America. The leaflets and the fruit are much larger than those of ordinary forms of *Swietenia Mahagoni*, from which, however, it does not appear to differ in any other respect.

[4] Gerard von Swieten (1700–1772); a native of Leyden, where he became a professor of medicine in the University, and a disciple of Boerhaave. Being a Roman Catholic, Swieten was obliged to resign his professorship in the Protestant University of Leyden; but Maria Theresa invited him to Vienna, where he reformed the study of medicine in the University, induced the empress to establish the Botanic Garden, and laid the foundation for the celebrated medical school.

SWIETENIA MAHAGONI.

Mahogany.

LEAVES persistent; leaflets ovate-lanceolate, falcate, unequally narrowed at the base.

Swietenia Mahagoni, Jacquin, *Enum. Pl. Carib.* 20; *Stirp. Am.* 127. — Linnæus, *Spec.* ed. 2, 548; *Mant.* 379. — Cavanilles, *Diss.* ii. 365, t. 209. — Gærtner, *Fruct.* ii. 89, t. 96. — Lamarck, *Dict.* iii. 678. — Willdenow, *Spec.* ii. 557. — Titford, *Hort. Bot. Am.* 64. — Descourtilz, *Fl. Med. Antil.* ii. 125, t. 99. — De Candolle, *Prodr.* i. 625. — Turpin, *Dict. Sci. Nat.* Atlas, t. 170. — Tussac, *Fl. Antil.* iv. 65, t. 23. — Hayne, *Arzn.* i. t. 19. — A. de Jussieu, *Mém. Mus.* xix. 248, t. 11. — Don, *Gen. Syst.* i. 687, f. 116. — Spach, *Hist. Veg.* iii. 164, t. 21. — Macfadyen, *Fl. Jam.* 175. — Torrey & Gray, *Fl. N. Am.* i. 242. — Walpers, *Rep.* i. 436. — Nuttall, *Sylva*, ii. 98, t. 75. — Richard, *Fl. Cub.* 304. — Schnizlein, *Icon.* t. 226, f. 1. — Chapman, *Fl.* 62. — Grisebach, *Fl. Brit. W. Ind.* 131. — Baillon, *Hist. Pl.* v. 478, f. 472–476. — Tippel & Bollevar, *Ausland. Cult. Pfl.* Atlas, i. t. 2, f. 1. — Brandis, *Forest Fl. Brit. Ind.* 70. — C. de Candolle, *Monogr. Phaner.* i. 723. — Hemsley, *Bot. Biol. Am. Cent.* i. 183. — Sargent, *Forest Trees N. Am.* 10*th Census U. S.* ix. 33.

Cedrus Mahogoni, Miller, *Dict.* No. 2.

S. macrophylla, King, *Hooker Icon.* xvi. t. 1550.

A tree, with a trunk forty or fifty feet in height and six or eight feet in diameter above the swell of the great buttresses which sometimes expand ten or twelve feet from the trunk, and with massive spreading branches. In Florida the Mahogany-tree is not now found more than forty or fifty feet in height, or with a trunk exceeding two feet in diameter, and is destitute of the buttresses which are developed on large individuals in regions more favorable for its growth. The bark of the trunk of the Florida trees is only one half to two thirds of an inch thick, with a dark red-brown surface broken into short broad and rather thick scales. The branchlets during their first season are glabrous, angled, and covered with pale red-brown bark, becoming lighter, or gray faintly tinged with red, and thickly covered with lenticels during the second year. The winter-buds are very short, with broadly ovate minutely apiculate light red scales. The leaves are four to six inches long, with slender glabrous petioles thickened at the base, and are composed of three or four pairs of leaflets. These are ovate-lanceolate, rounded at the base on the upper side, and narrowly wedge-shaped or nearly straight on the lower; they are entire, coriaceous, pale yellow-green or slightly rufous on the under surface, three or four inches long and an inch or an inch and a half broad, with stout grooved petiolules a quarter of an inch long, prominent reddish brown midribs, and conspicuous reticulate veins. The flowers appear in July and August, and are produced one or two together at the ends of the branches of the slender panicles which are developed from the axils of the leaves of the year. The flower-buds are ovate, an eighth of an inch long, or half the length of the slender puberulous pedicels which bear near the middle a pair of minute acute membranaceous bracts. The calyx is glabrous, cup-shaped, and much shorter than the ovate elliptical white petals which are an eighth of an inch long and slightly emarginate at the apex. The staminal tube, with its acute lobes, is glabrous, as are the ovary and the fleshy disk; the anthers are elliptical and slightly emarginate at the apex. The fruit, which ripens in the autumn or early winter, is long-stalked, four or five inches in length and two and a half inches broad, with thick dark brown valves rugose and pitted on the surface. The axis of the fruit is three or four inches long and an inch or an inch and a half thick, dark red-brown, and marked near the apex with the small scars left by the falling of the seeds. These are three quarters of an inch long, almost square, thickened at the base, and nearly a quarter the length of the thick ovate rugose red-brown wing which is rounded or truncate at the apex and gradually contracted below.

Swietenia Mahagoni grows in Florida on Key Largo and on Elliott's Key.[1] It is found on the Bahama and West India islands; it is widely distributed in tropical Mexico and Central America, and occurs in Peru.[2]

The wood of *Swietenia Mahagoni*, the mahogany of commerce,[3] is heavy, exceedingly hard and strong, close-grained and very durable. It contains numerous obscure medullary rays, and possesses a rich red-brown color which becomes darker with age and exposure. The yellow sapwood consists, in the Florida trees, of about twenty layers of annual growth, and is not more than an inch thick. The specific gravity of the absolutely dry wood grown in Florida is 0.7282, a cubic foot of the dry wood weighing 45.38 pounds.[4] Mahogany is probably the most esteemed of all woods in cabinet-making,[5] and is also largely used in the interior finish of buildings and railroad cars; formerly it was employed in ship and boat building, for which purpose it was particularly adapted by its combination of strength and lightness and its power to resist decay.[6]

The bark of *Swietenia Mahagoni* is bitter and astringent, and although not admitted into the Materia Medica, is sometimes used with quinine in the treatment of intermittent fevers.[7]

The Mahogany-tree did not attract the attention of early European travelers in America. They were seeking spices and plants possessed of medicinal virtues, and had little interest in trees principally valuable for their timber. Sloane, who carefully explored the forests of Jamaica, overlooked Swietenia entirely, and it was Mark Catesby who, having discovered it in the Bahama Islands, first described this tree in his *Natural History of Carolina*, published in 1734.[8] The earliest mention of the Mahogany-tree as an inhabitant of Florida appeared in William Stork's *Description of East Florida*.[9]

Swietenia Mahagoni was probably first sent to Europe by Catesby. It was cultivated in the Chelsea Physic Garden near London in 1739,[10] and was planted in the Botanic Garden at Calcutta in 1795.[11]

[1] It is probable that the Mahogany-tree was once more common on the Florida keys than it is at present, as thirty or forty years ago, or even earlier, considerable quantities of the wood were cut and sent to the Bahama Islands for export to Europe, and all the large trees were destroyed.

[2] Ruiz, in *Herb. Berol. fide* C. de Candolle, *l. c.*

[3] The wood of other trees sometimes appears in commerce under the name of mahogany, although very inferior to that of Swietenia. Madeira mahogany is the wood of *Persea Indica*, Sprg. *Khaya Senegalensis*, A. Juss., a large tree of west-tropical Africa, supplies the so-called African mahogany, and *Soymida febrifuga*, A. Juss., the Indian wood sold in England as mahogany. The Bastard mahogany of the West Indies is the wood of *Cedrella odorata*, L.

[4] The Mahogany-tree grows rapidly under favorable conditions in Central America, sometimes attaining in two hundred years a trunk diameter of four feet. In Florida it grows much more slowly. The two Florida logs in the Jesup collection of North American woods in the American Museum of Natural History in New York measure respectively twenty-two and a half and eighteen and a quarter inches in diameter; the first has two hundred and four layers of annual growth, and the second two hundred and fourteen.

[5] Labat, *Nouveau Voyage aux Isles de l'Amérique*, v. 192; vi. 304 (1772). — Givelt, *Encyclopædia of Architecture*, 301. — M'Cullough, *Dictionary, Practical, Theoretical and Historical, of Commerce and Commercial Navigation.* — Honori Havard, *Dictionnaire de l'ameublement et de decoration*, 1.

[6] Laslett, *Timber and Timber Trees*, 170.

Several grades of mahogany are recognized by timber merchants. They are distinguished by the weight, the character of the grain, and the color of the wood, which are affected by the soil and situation in which the trees have grown. Trees in high rocky situations on mountain slopes, especially on limestone soil, produce the most valuable wood, while the poorer qualities come from trees grown in the forests which border the rivers near the coast of Central America. The finest mahogany came originally from San Domingo, Cuba, and Jamaica, where the supply is now practically exhausted. The best now grows on the lower slopes of the mountains of southern Mexico, British Honduras, and Guatemala.

The methods employed in cutting the Mahogany-tree and in getting the logs to the coast are described in the article on *Swietenia Mahagoni* in Hooker's *Botanical Miscellany*, i. 21. Descriptions of the tree and of the modes of cutting it will also be found in Wells' *Explorations and Adventures in Honduras*, 346, in Morris's *Colony of British Honduras*, and in Brigham's *Guatemala, the Land of the Guetzal.*

[7] Woodville, *Med. Bot.* ed. 3, iii. 620, t. 220. — *U. S. Dispens.* ed. 14, 1768. — Guibourt, *Hist. Drog.* ed. 7, iii. 595.

[8] *Arbor foliis pinnatis, Alam claudente, nullo impari: nervo ad latus unum excurrente*, etc., ii. 81, t. 81.

Cedrela foliis pinnatis, floribus sparsis, ligno graviori, Browne, *Nat. Hist. Jam.* 158.

[9] "Mahogany grows only in the southern and interior parts of the peninsula; it is in size and quality inferior to the Jamaica, but good enough to become an article of trade. The woodcutters from the province come to east Florida to cut Mahogany and carry it off clandestinely." The first edition of this book is not dated. The third edition, which appeared probably only a few years later, was published in 1769.

[10] Aiton, *Hort. Kew.* ii. 59.

[11] The trees in Calcutta had attained a large size in 1864, when they were blown down by the hurricane which devastated the garden. In 1865 efforts were made to introduce the Mahogany-tree into India on a large scale. They were only partially successful,

Mahagoni,[1] first used by Jacquin as the specific name of this tree, is of aboriginal derivation.

but are being continued in both Bengal and Burmah with seeds obtained from America, and it is now believed that the Indian forests will eventually produce mahogany in large quantities and of excellent quality. (Gamble, *Man. Ind. Timbers*, 74. — *Rep. Forest Dept. Ind.* 1888–89, 30.)

[1] The change in Jacquin's specific name from *Mahagoni* to *Mahogoni* was made by Miller in the eighth edition of his dictionary; and Miller's orthography was afterwards adopted by De Candolle.

EXPLANATION OF THE PLATES.

Plate XLIII. Swietenia Mahagoni.

1. A flowering branch, natural size.
2. Diagram of a flower.
3. A flower bud, enlarged.
4. A flower, enlarged.
5. Vertical section of a flower, enlarged.
6. A pistil, with the staminal tube displayed, enlarged.
7. Vertical section of an ovary, enlarged.

Plate XLIV. Swietenia Mahagoni.

1. A fruiting branch, natural size.
2. A fruit, with one of the valves and the outer lamella of another removed, natural size.
3. The axis of a fruit, natural size.
4. A seed, natural size.
5. Cross section of a seed, natural size.
6. Vertical section of a seed, natural size.
7. An embryo, much enlarged.

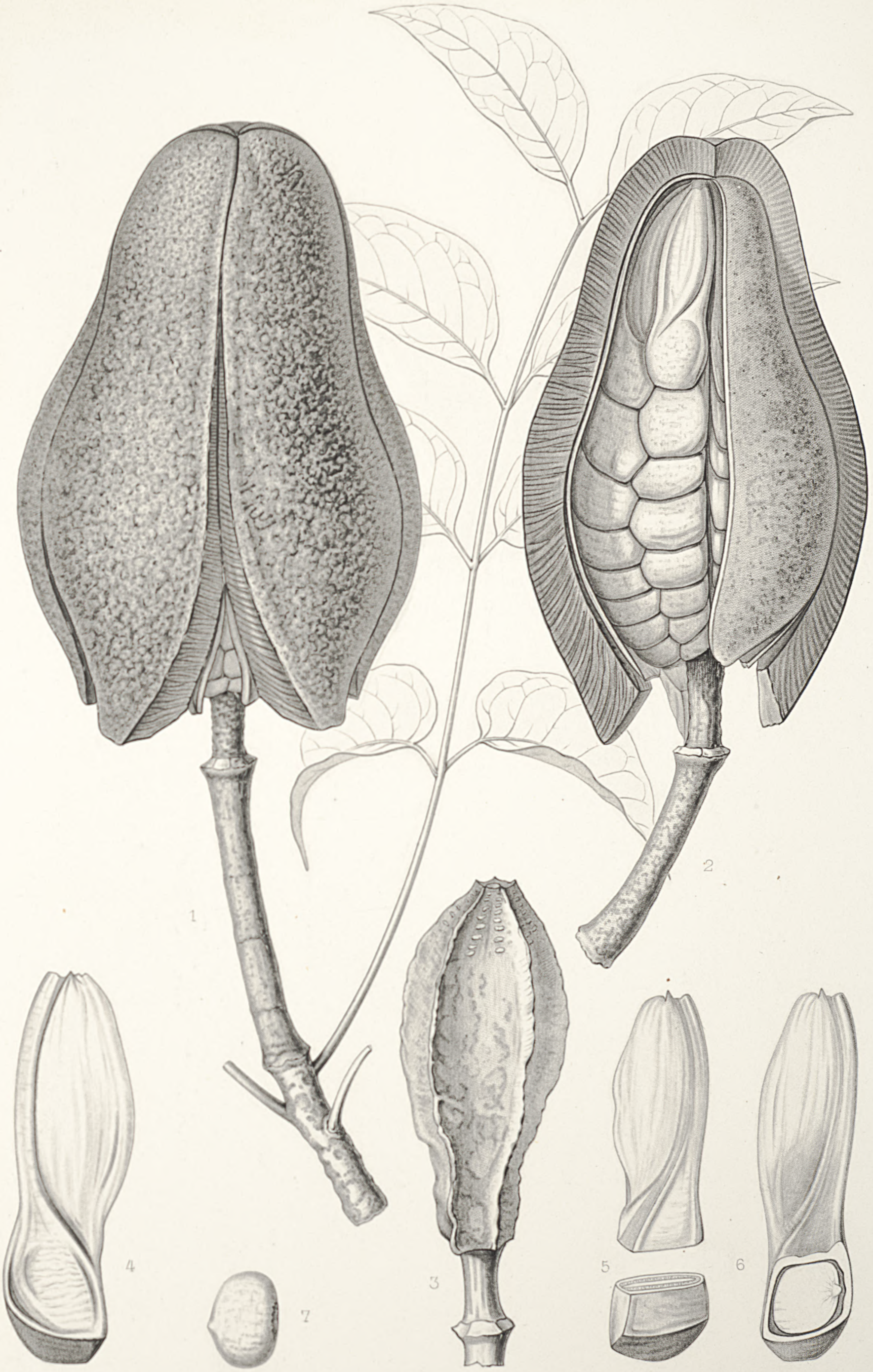
C.E. Faxon del.

Picart fr. sc.

SWIETENIA MAHAGONI, Jacq.

A. Riocreux direx.t

Imp. R. Taneur. Paris.



C.E.Faxon del.

Picart fr. sc.

SWIETENIA MAHAGONI, Jacq.

A. Riocreux direx.t

Imp. R. Taneur. Paris.

ILEX.

Flowers usually polygamo-diœcious; calyx 4 to 6-lobed, imbricated in æstivation, persistent; petals 4 to 6, free or united at the base, imbricated in æstivation, hypogynous. Fruit, a berry-like drupe.

Ilex, Linnæus, *Gen.* 33. — A. L. de Jussieu, *Gen.* 379. — Endlicher, *Gen.* 1092. — Meisner, *Gen.* 252. — Bentham & Hooker, *Gen.* i. 356.

Prinos, Linnæus, *Cor. Gen.* 6; *Gen.* ed. 2, 952. — A. L. de Jussieu, *Gen.* 379. — Endlicher, *Gen.* 1092. — Meisner, *Gen.* 252.

Aquifolium, Adanson, *Fam. Pl.* ii. 166.

Ageria, Adanson, *Fam. Pl.* ii. 166 (in part).

Macoucoua, Aublet, *Pl. Guian.* i. 88, t. 34.

Paltoria, Ruiz & Pavon, *Fl. Peruv.* i. 54, t. 84, f. b.

Chomellia, Vellozo, *Fl. Flum.* i. t. 106.

Pileostegia, Turczaninow, *Bull. Mosc.* xxxii., i. 276.

Pseudehretia, Turczaninow, *Bull. Mosc.* xxxvi., i. 607.

Trees and shrubs, with watery juice. Leaves alternate, petiolate, persistent or deciduous, often nitidous, entire, dentate or spinescent, stipules minute, deltoid or subulate, chartaceous, or filiform and membranaceous, deciduous. Flowers minute, in axillary cymes, fascicles, or umbellules. Calyx minute, four or six-lobed, persistent. Corolla rotate; petals oval or oblong, obtuse, free or united at the base, white or greenish white, deciduous. Stamens inserted on the base of the corolla, as many as and alternate with its divisions; filaments subulate, exserted in the sterile, much shorter in the fertile flower; anthers attached on the back, oblong, introrse, two-celled, the cells opening longitudinally; effete or rudimentary in the fertile flower. Ovary free, sessile, subcylindrical, two to twelve-celled; rudimentary in the sterile flower; style short or wanting; stigmas as many as the cells of the ovary, distinct or confluent; ovules one or two in each cell, suspended from near their apex, collateral, anatropous; raphe dorsal or rarely lateral; the micropyle superior. Fruit drupaceous, subglobose, crowned with the remnants of the stigma; sarcocarp fleshy; nutlets usually four to eight, bony or crustaceous, one-seeded. Seeds suspended; testa membranaceous. Embryo minute, in the apex of the copious fleshy albumen, subglobose, two-lobed; the radicle superior.[1]

The genus Ilex is widely distributed over the tropical and temperate parts of the world with the exception of western North America, Australia, New Zealand, Tasmania, and New Guinea. About one

[1] The genus Ilex was separated by Asa Gray (*Man. Bot. N. States*, ed. 5) into the following sections: —

1. Aquifolium. Parts of the flower usually in fours, sometimes in fives or sixes; drupe red, nutlets ribbed, veiny or one-grooved on the back; leaves coriaceous, persistent.

2. Prinoides. Parts of the flower in fours or fives, or rarely in sixes; drupe red or purple, nutlets striate, many ribbed on the back; leaves deciduous.

3. Prinos. Parts of the staminate flower commonly in fours, fives, or sixes; parts of the pistillate flowers commonly in sixes, or rarely in fives, sevens, or eights; nutlets smooth.

Maximowicz (*Mém. Acad. Sci. St. Pétersbourg*, ser. 7, xxix. 20) proposes the following sections for the genus: —

1. Paltoria. Parts of the flower in fours or very rarely in fives; pedicels produced from the shoots of the year. Intricately branched evergreen shrubs or small trees, with small coriaceous often punctate leaves destitute of spiny teeth.

2. Ilex. Parts of the flower generally more than four; pedicels produced with the young leaves from the shoots of the year. Trees or rarely tall shrubs, with ample persistent coriaceous or chartaceous entire or serrate leaves, never spinescent, even when young.

3. Aquifolium. Parts of the flower generally in fours. Trees or usually tall shrubs, with ample persistent or rarely chartaceous and usually spino-serrate leaves; cymes aggregated from the old wood or occasionally solitary from shoots of the year.

4. Prinos. Parts of the flower usually in fives; pedicels produced from shoots of the year. Trees or shrubs, with deciduous membranaceous leaves and succulent drupes.

hundred and seventy-five species are now recognized,[1] the headquarters of the genus, as represented by the largest number of species, being in Brazil and Guiana,[2] where sixty-seven are known. The mountain regions of western South America contain at least ten species;[3] seven have been distinguished in southern Mexico and Central America,[4] and ten in the West Indies;[5] while in eastern North America there are thirteen or perhaps fourteen species[6] of which four are small trees. The genus is, therefore, nearly two thirds American. The flora of Europe contains a single species of Ilex; the Canary Islands and Madeira possess three species;[7] one is south African,[8] and one is found on the island of Madagascar.[9] Twenty-four species grow in India;[10] twenty-eight or thirty are already known in China and Japan;[11] three species have been found in the islands of the Indian Archipelago,[12] and two in Polynesia.[13]

In the early Tertiary period Ilex existed in the Arctic regions[14] with several forms, among them *Ilex spinescens*, in which Saporta finds the probable remote ancestor of the existing European species and of the spiny-leaved Holly of North America,[15] and *Ilex stenophylla*,[16] which is reproduced in *Ilex Cassine* of the southern United States. The genus had several representatives at this period in western North America, whence it has now disappeared.[17]

Ilex contains a bitter principle, Ilicine, combined with glutinous matter and an aromatic resin, and possesses tonic, and sometimes diuretic, diaphoretic, and emetic properties. *Ilex Paraguariensis*,[18] a tree widely distributed from Brazil to Paraguay, furnishes the maté or Paraguay tea of the South Americans, and is the most useful species to man. The leaves of the European Holly were formerly sometimes used as a febrifuge;[19] the fruit is purgative and emetic; bird-lime is prepared from the inner bark,[20] and the hard close-grained white wood is used in turnery and cabinet-making. The European Holly has been a favorite garden plant for centuries, and innumerable varieties, with variously shaped and curiously variegated leaves and with abnormally colored fruit, have been produced and are esteemed by European gardeners.[21] The Holly is also a favorite hedge plant.[22] Branches of Holly were sent by the Romans to their friends as emblems of good-will at the festival of the Saturnalia. The early Christians of Rome used them to decorate their places of worship,[23] and this custom still prevails in Europe and in America, where bunches of the native Hollies are now in great demand for Christmas decoration. The shrubby

[1] Maximowicz, *Mém. Acad. Sci. St. Pétersbourg*, ser. 7, xxix. 18.

[2] Reissek, *Martius Fl. Brasil.* xi. 1, 39, t. 12–21. — Maximowicz, *l. c.* 25.

[3] Humboldt, Bonpland & Kunth, *Nov. Spec. et Gen.* vii. 70.

[4] Hemsley, *Bot. Biol. Am. Cent.* i. 186.

[5] Grisebach, *Fl. Brit. W. Ind.* 146. — Maximowicz, *l. c.* 27.

[6] Trelease, *Trans. St. Louis Acad. Sci.* v. 345.

[7] Barker-Webb & Berthelot, *Phytogr. Canar.* ii. 135, t. 68, 69.

[8] Harvey & Sonder, *Fl. Cap.* i. 473.

[9] Tulasne, *Ann. Sci. Nat.* viii. 111.

[10] Hooker f. *Fl. Brit. Ind.* i. 598. — Maximowicz, *l. c.* 24.

[11] Franchet & Savatier, *Enum. Pl. Jap.* i. 76. — Maximowicz, *l. c.* 32. — Forbes & Hemsley, *Jour. Linn. Soc.* xxiii. 115.

[12] Miquel, *Fl. Ind. Bat.* ii. 594.

[13] Gray, *Bot. N. Pacific Explor. Exped.* i. 295, t. 25. — Maximowicz, *l. c.* 23.

[14] Heer, *Fl. Foss. Arct.* vi.; *Fl. d. Ataneschicht.* 97, t. 27, f. 1, a; *Grönland.* 15, t. 6, f. 6.

[15] *Origine Paléontologique des Arbres*, 289.

[16] Saporta, *l. c.*

[17] Lesquereux, *Contrib. Foss. Fl. West. Territ.* ii. *Tertiary*, 270, t. 50, f. 1–9 (*Hayden's Rep.* vii. 1878).

[18] St. Hilaire, *Mém. Mus.* ix. 351. — D. Don, *Lambert Pin.* ii. Appx. t. 4. — Reissek, *Martius Fl. Brasil.* xi. 1, 162, t. 13, f. 15; t. 19, 20.

The leaves of *Ilex Paraguariensis*, which contain a principle identical with the caffeine of tea and coffee, are stripped from the trees once in every two or three years during the summer months, that is, from December to August. As fast as gathered they are dried over slow fires, and are then reduced to powder and carefully protected from moisture during the seasoning period, which sometimes lasts for several months. The powder is then packed in sacks and is ready for use. It has a bitter taste and a balsamic odor, and is used in the form of an infusion, which has a pleasant stimulating effect on the human stomach. Maté has wonderful power in increasing the ability of the human frame to endure sustained physical effort; but the habit of using it being once acquired is not easily given up, and taken in excess maté produces the same physical and mental derangements which follow the excessive use of alcohol. (Hooker, *London Jour. Bot.* i. 30, t. 1–3. — Lindley, *Treasury of Botany*, ii. 618. — Wittstein, *Vierteljahresschrift*, xvi. 167. — Guibourt, *Hist. Drog.* ed. 7, iii. 544. — *U. S. Dispens.* ed. 14, 1670. — Naudin, *Manuel de l'Acclimateur*, 315.)

[19] Lindley, *Fl. Med.* 393. — Guibourt, *Hist. Drog.* ed. 7, iii. 543. — *U. S. Dispens.* ed. 14, 670.

[20] Evelyn, *Silva*, ed. Hunter, i. 268.

[21] Loudon, *Arb. Brit.* ii. 506. — Nicholson, *Dict. Gard.*

[22] Loudon, *l. c.* 509.

[23] Loudon, *l. c.* 511.

North American species of the section Prinos are cultivated for their showy persistent fruit, and some of the Asiatic species are also occasionally seen in gardens.

The name of the genus was bestowed upon it by Linnæus, who discarded Tournefort's generic name, Aquifolium,[1] and adopted the classical name of the Evergreen Oak of southern Europe, Ilex, on account of the resemblance of its leaves to those of the European Holly.

[1] *Inst.* 600, t. 371.

CONSPECTUS OF THE NORTH AMERICAN ARBORESCENT SPECIES.

AQUIFOLIUM. Parts of the flower in fours; pedicels bracted at the base; nutlets prominently few-ribbed on the back and sides; leaves evergreen.

Leaves armed with spiny teeth.

Young shoots glabrous or sparingly pubescent . . . . . 1. I. OPACA.

Leaves serrate or entire.

Young shoots pubescent; calyx-lobes acuminate . . . . . 2. I. CASSINE.

Young shoots puberulous; calyx-lobes obtuse . . . . . 3. I. VOMITORIA.

PRINOIDES. Parts of the flower in fours or fives, rarely in sixes; pedicels destitute of bracts; nutlets striate, many-ribbed on the back; leaves deciduous.

Calyx-lobes broadly-triangular; leaves cuneate, oblong-spatulate, or lanceolate-obovate . 4. I. DECIDUA.

Calyx-lobes acute; leaves ovate or lanceolate-oblong . . . . . 5. I. MONTICOLA.

ILEX OPACA.

Holly.

PARTS of the flower in 4's; calyx-lobes acute; leaves spinose-dentate.

Ilex opaca, Aiton, *Hort. Kew.* i. 169. — Willdenow, *Spec.* i. 708; *Enum.* 172; *Berl. Baumz.* 189. — *Nouveau Duhamel*, i. 8. — Michaux, *Fl. Bor.-Am.* ii. 228. — Persoon, *Syn.* i. 151. — Poiret, *Lam. Dict.* Suppl. iii. 65. — Michaux, f. *Hist. Arb. Am.* ii. 191, t. 11. — Pursh, *Fl. Am. Sept.* i. 117. — Rafinesque, *Fl. Ludovic.* 111; *Med. Bot.* ii. 7, t. 53. — Roemer & Schultes, *Syst.* iii. 487. — Link, *Enum.* 147. — Hayne, *Dendr. Fl.* 10. — Torrey, *Fl. U. S.* 194; *Fl. N. Y.* ii. 2. — Elliott, *Sk.* ii. 679. — De Candolle, *Prodr.* ii. 14. — Sprengel, *Syst.* i. 495. — Watson, *Dendr. Brit.* i. 3, t. 3. — Loudon, *Arb. Brit.* ii. 516, t. — Hooker, *Fl. Bor.-Am.* i. 121. — Bigelow, *Fl. Boston.* 41. — Don, *Gen. Syst.* ii. 17. — Spach, *Hist. Veg.* ii. 427. — Dietrich, *Syn.* i. 554. — Griffith, *Med. Bot.* 432. — Emerson, *Trees Mass.* ed. 2, ii. 385, t. — Darlington, *Fl. Cestr.* ed. 3, 175. — Chapman, *Fl.* 269. — Curtis, *Rep. Geolog. Surv. N. Car.* 1860, iii. 58. — Maximowicz, *Mém. Acad. St. Pétersbourg*, ser. 7, xxix. 29. — Sargent, *Forest Trees N. Am.* 10*th Census U. S.* ix. 34. — Trelease, *Trans. St. Louis Acad.* v. 345. — Watson & Coulter, *Gray's Man.* ed. 6, 108.

I. **Aquifolium**, Linnæus, *Spec.* 125 (in part). — Marshall, *Arbust. Am.* 63. — Walter, *Fl. Car.* 241.

I. **laxiflora**, Lamarck, *Dict.* iii. 147; *Ill.* i. 355. — Pursh, *Fl. Am. Sept.* i. 117. — Roemer & Schultes, *Syst.* iii. 494; *Mant.* iii. 334. — De Candolle, *Prodr.* ii. 14. — Sprengel, *Syst.* i. 495. — Don, *Gen. Syst.* ii. 17. — Spach, *Hist. Veg.* ii. 427. — Dietrich, *Syn.* i. 555. — Loudon, *Arb. Brit.* ii. 517.

"I. quercifolia, Meerburgh, *Icon.* t. 5."

Ageria opaca, Rafinesque, *Sylva Tellur.* 47.

A tree, forty to fifty feet in height, with a trunk two or three, or exceptionally four feet in diameter, with short slender branches forming a narrow pyramidal head, and thick fleshy roots. The bark of the trunk is half an inch thick, with a light gray surface roughened by wart-like excrescences. The stout branchlets are covered, when they first appear, with fine rufous pubescence which disappears by the end of the season, when they are glabrous and pale brown. The winter-buds are short, obtuse or acuminate, with narrow acuminate scales ciliate on the margins. The leaves are elliptical or obovate-oblong, pungently acute, with thickened wavy margins and a few stout spinose teeth, or sometimes quite entire, especially on the upper branches;[1] they are two to four inches long, with a prominent midrib and conspicuous veins, and are borne on short stout petioles thickened at the base, grooved above, and, like the midrib, slightly puberulent. They are thick, coriaceous, dull yellow-green, paler and often quite yellow on the lower surface, and remain on the branches for three years, falling when the growth begins in the spring. The stipules are minute, broadly acute or nearly deltoid and persistent. The sterile and fertile flowers are produced on different plants in short pedunculate cymes from the axils of the young leaves, or are scattered along the base of the young shoots. The inflorescence is three to nine-flowered on the sterile plant, and one or rarely two or three-flowered on the fertile. The slender peduncles and pedicels are puberulous with minute acute bracts near their base. The flowers open in spring; they are characterized by acute calyx-lobes with ciliate margins, and by the broad sessile stigma. The fruit, which ripens late in the autumn, remains on the branches until the early spring of the following year; it is spherical or ovoid, a quarter of an inch across, dull red or rarely yellow. The nutlets are prominently few-ribbed on the back and sides, nearly triangular, and rather narrower towards the apex than at the base.

The most northern station of *Ilex opaca* is near the coast of Massachusetts Bay in the city of Quincy. It is rare on the coast of New England and New York where it never grows to a large size, becomes larger and more common south of the Hudson River, and extends south, generally near the coast, to the shores of Mosquito Inlet and Charlotte Harbor, Florida. It is exceedingly rare in the

[1] Mellichamp, *Bull. Torrey Bot. Club*, viii. 112.

Alleghany-mountain region and in the country immediately west of it, but reappears in the valley of the Mississippi River, extending from southern Indiana to the Gulf of Mexico, and through Missouri, Arkansas, and Louisiana to eastern Texas.

Ilex opaca generally grows at the north in dry, rather gravelly soil, and often on the margins of Oak woods; at the south it is found on the borders of swampy river-bottoms in rich, rather humid soil, often growing under the shade of Water Oaks, Gums, and Bay-trees. It reaches its greatest size on the fertile bottom-lands of the streams of southern Arkansas and eastern Texas, where it is more abundant than in other parts of the country.

The wood of *Ilex opaca* is light, tough, although not strong, and very close-grained. It contains numerous thin and inconspicuous medullary rays, and is nearly white when first cut, turning brown with age and exposure, the thick sapwood being rather lighter colored than the heartwood. It can be easily worked, and will receive a beautiful polish, and is valued and now much employed in cabinet-making, in the interior finish of buildings, and in turnery. The specific gravity of the absolutely dry wood is 0.5818, a cubic foot weighing 36.26 pounds. Ilicine has been obtained from the fruit of *Ilex opaca*,[1] which furnishes the principal supply of the Holly branches which are now used in this country in large quantities for decoration at Christmas festivals.

The American Holly, owing to its resemblance to the familiar Holly of European gardens, naturally attracted the attention of the early voyagers to America, and it was noticed as early as 1564 by the party of French Protestants who landed near the mouth of the St. John's River in Florida under the leadership of Laudonnière.[2] It was first described by Clayton in the *Flora Virginica*,[3] and, according to Aiton, was first cultivated in Europe in 1744 by the Duke of Argyll.[4] It may still be occasionally seen in European gardens, and is sometimes cultivated in the United States.[5] The number of insects known to injure the American Hollies is not large, and the damage they inflict is not serious.[6]

[1] *Am. Jour. Pharm.* xxviii. 314. — *U. S. Dispens.* ed. 14, 1670.

[2] "Frequentes cedri, cupressi, lauri, palmæ, aquifoliæ & vites sylvestri." (*Le Moyne de Morgue, De Bry Voyages*, Part II. 3.)

[3] *Ilex foliis ovatis acutis dentatis*, 18.

[4] Archibald Campbell, third Duke of Argyll (1680–1761); the most assiduous collector and planter of exotic trees of his time in England, and Horace Walpole's "Tree-Monger." Many of the trees which were planted in the grounds of his villa of Whitton, near Hounslow, were after his death removed to the Royal Gardens at Kew, where they formed the basis of the present Arboretum.

[5] The thick fleshy roots of this tree make it difficult to transplant successfully. The seeds, like those of many species of Holly, do not germinate until the second year after planting.

[6] The Fall Web-worm (*Hyphantria cunea*, Drury) is sometimes quite injurious to the foliage of species of Ilex (*Bull.* No. 10, *Div. Entomol. Dept. Agr. U. S.* 40). Larvæ of a small moth, *Cryptolechia cryptolechiella*, Chamb., fasten leaves of *Ilex opaca* together and feed upon them (*Bull. Hayden's U. S. Geolog. Surv.* 1878, iv. pp. 84, 116).

EXPLANATION OF THE PLATE.

Plate XLV. Ilex opaca.

1. A branch with staminate flowers, natural size.
2. A branch with pistillate flowers, natural size.
3. Diagram of a flower.
4. A staminate flower, enlarged.
5. Vertical section of a staminate flower, enlarged.
6. A pistillate flower, enlarged.
7. Vertical section of a pistillate flower, enlarged.
8. Cross section of an ovary, enlarged.
9. An ovule, much magnified.
10. A fruiting branch, natural size.
11. Vertical section of a fruit, enlarged.
12. Cross section of a fruit, enlarged.
13. A nutlet, enlarged.
14. An embryo, much magnified.
15. Part of a leaf with a stipule, enlarged.

C.E. Faxon del.

Picart fr. sc.

ILEX OPACA, Ait.

A. Riocreux dirext. Imp. R. Taneur, Paris.

ILEX CASSINE.

Dahoon.

PARTS of the flower in 4's; calyx-lobes acuminate. Leaves entire or sharply serrate towards the apex.

Ilex Cassine, Linnæus, *Spec.* 125 (excl. β.). — Marshall, *Arbust. Am.* 64. — Lamarck, *Dict.* iii. 147; *Ill.* i. 355. — Willdenow, *Spec.* i. 709; *Enum.* 172; *Hort. Berol.* i. t. 31. — *Nouveau Duhamel*, i. 9. — Persoon, *Syn.* 151. — Desfontaines, *Hist. Arb.* ii. 362. — Poiret, *Lam. Dict.* Suppl. iii. 65. — Pursh, *Fl. Am. Sept.* i. 117. — Roemer & Schultes, *Syst.* iii. 490. — Hayne, *Dendr. Fl.* 10. — De Candolle, *Prodr.* ii. 14. — Sprengel, *Syst.* i. 495. — Don, *Gen. Syst.* ii. 17. — Spach, *Hist. Veg.* ii. 428. — Dietrich, *Syn.* i. 554. — Loudon, *Arb. Brit.* ii. 517, f. 184. — C. Koch, *Dendr.* ii. 223 (excl. syn.). — Goeppert, *Del. Sem. Vratisl.* 1852 (*Linnæa*, xxvi. 746). — Sargent, *Garden and Forest*, ii. 616.

Ilex Dahoon, Walter, *Fl. Car.* 241. — Michaux, *Fl. Bor.-Am.* ii. 228. — Pursh, *Fl. Am. Sept.* i. 117. — Nuttall, *Gen.* i. 109. — Roemer & Schultes, *Syst.* iii. 489; *Mant.* iii. 332. — De Candolle, *Prodr.* ii. 14. — Elliott, *Sk.* ii. 680. — Watson, *Dendr. Brit.* ii. 114, t. 114. — Sprengel, *Syst.* i. 495. — Audubon, *Birds*, t. 48. — Don, *Gen. Syst.* ii. 19. — Spach, *Hist. Veg.* ii. 428. — Dietrich, *Syn.* i. 554. — Loudon, *Arb. Brit.* ii. 519. — Griffith, *Med. Bot.* 433. — Chapman, *Fl.* 269. — Curtis, *Rep. Geolog. Surv. N. Car.* 1860, iii. 58. — Maximowicz, *Mém. Acad. St. Pétersbourg*, ser. 7, xxix. 29. — Sargent, *Forest Trees N. Am. 10th Census U. S.* ix. 35. — Trelease, *Trans. St. Louis Acad.* v. 345. — Watson & Coulter, *Gray's Man.* ed. 6, 108.

I. Cassine, var. **latifolia**, Aiton, *Hort. Kew.* i. 170.

I. cassinoides, Link, *Enum.* i. 148. — Roemer & Schultes, *Mant.* iii. 332.

I. laurifolia, Nuttall, *Am. Jour. Sci.* v. 289. — Eaton, *Man.* ed. 6, 186. — Eaton & Wright, *Bot.* 282.

Ageria palustris, Rafinesque, *Sylva Tellur.* 47.

Ageria obovata, Rafinesque, *Sylva Tellur.* 48.

Ageria heterophylla, Rafinesque, *Sylva Tellur.* 48.

A small tree, twenty-five to thirty feet in height, with a trunk twelve to eighteen inches in diameter; or, in some forms, a low tree-like shrub. The bark of the trunk is hardly more than one sixteenth of an inch thick, with a dark gray surface thickly covered and roughened with lenticels. The young branches are coated with dense silky pubescence which does not disappear until the end of the second or third year, when they are dark brown and marked with occasional lenticular spots. The winter-buds are acute with lanceolate scales thickly covered with pale silky pubescence. The leaves are oblanceolate or obovate-oblong, acuminate at the base, acute, mucronate or rarely rounded at the apex, with revolute margins entire or sometimes serrate above the middle with sharp mucronate teeth; they are puberulous above and densely covered with pubescence below when they first unfold, glabrous at maturity with the exception of occasional hairs on the lower surface of the broad midrib, which is conspicuously grooved on the upper surface, and on the short thick petiole which is thickened at the base. They are dark green and lustrous on the upper surface, and pale on the lower. The minute caducous stipules are filiform. The infloresence is sometimes nearly an inch long, generally much shorter, pedunculate, and produced from the young shoots or occasionally from the branches of the previous year. It is three to nine-flowered on the sterile plant, and usually three-flowered on the fertile. The pedicels are covered with hairs, and furnished at their base with acute scarious bracts. The calyx-lobes are acute, with ciliate margins. The fruit, which ripens late in the autumn and remains on the branches until the following spring, is globose, sometimes a quarter of an inch in diameter, bright or occasionally dull red or nearly yellow, with stout densely pubescent pedicels, solitary or often in clusters of threes. The nutlets are prominently few-ribbed on the back and sides.

Ilex Cassine grows from southern Virginia southward in the immediate neighborhood of the coast to the shores of Bay Biscayne and Tampa Bay, Florida, and westward along the Gulf coast to western Louisiana. It is found in cold swamps, or more often along their borders in rich humid soil, and occasionally near the Gulf coast on the high sandy banks of pine-barren streams. The Dahoon is nowhere

common on the Atlantic seaboard. It occurs more frequently in Florida and in southern Alabama, gradually disappearing towards the western limits of its range.

The wood of *Ilex Cassine* is light, soft, and close-grained, but not strong; it contains many thin medullary rays, and is pale brown with thick nearly white sapwood. The specific gravity of the absolutely dry wood is 0.4806, a cubic foot weighing 29.95 pounds.

The Dahoon Holly[1] was first described in the *Natural History of Carolina*[2] by Mark Catesby, who sent seeds to Europe which produced plants in the Physic Garden at Chelsea.[3]

Ilex Cassine varies remarkably in the size and shape of its leaves, passing through forms with elongated narrow leaves[4] into the variety *myrtifolia*.[5] This is a low shrub, or occasionally a slender wide-branching tree with pale nearly white bark, puberulous branchlets, and crowded, generally entire mucronate leaves which are half an inch to nearly an inch in length and an eighth of an inch broad, with reflexed margins, very short petioles, and broad prominent midribs. The fruit is short-stalked and much smaller than that of *Ilex Cassine*. This plant, which is found in the neighborhood of the coast from North Carolina to Louisiana, always inhabits cypress-swamps and pine-barren ponds or their margins, and is much more common than the Dahoon, from which many careful observers are inclined, perhaps with reason, to consider it specifically distinct. The wood is heavier and lighter colored than that of the Dahoon, with a specific gravity, when absolutely dry, of 0.5873, a cubic foot weighing 36.60 pounds.

[1] The confusion in the names of the two arborescent Hollies of the southern states commenced in the *Hortus Cliffortianus*, in which Linnæus united them under his *Ilex foliis ovato-lanceolatis*, etc. It was increased in the *Species Plantarum*, in which the Dahoon of the American Indians was made the type of the *Ilex Cassine*, and the aboriginal Cassina a variety of it; so that the oldest Linnæan specific name of the Dahoon Holly is the well established and familiar vernacular name of a different tree of the same region.

[2] *Agrifolium Cariolinense foliis dentatis baccis rubris*, i. 31, t. 31.

Ilex foliis ovato-lanceolatis serratis, Linnæus, *Hort. Cliff.* 40 (excl. syn. Plukenet). — Royen, *Fl. Leyd. Prodr.* 400.

Ilex maritima ramosa foliis oblongis non sinuatis, glandibus esculentis, Clayton, *Fl. Virgin.* 18.

[3] Miller, *Dict.*

[4] *Ilex Cassine*, var. *angustifolia*, Willdenow, *Spec.* i. 709. — Aiton, *Hort. Kew.* i. 170. — *Nouveau Duhamel*, i. 9, t. 3. — Sargent, *Garden and Forest*, ii. 616.

I. angustifolia, Willdenow, *Enum.* 172. — Pursh, *Fl. Am. Sept.* i. 118. — Nuttall, *Gen.* i. 109. — Roemer & Schultes, *Syst.* iii. 489. — De Candolle, *Prodr.* ii. 14. — Watson, *Dendr. Brit.* i. 4, t. 4. — Sprengel, *Syst.* i. 495. — Don, *Gen. Syst.* ii. 17. — Spach, *Hist. Veg.* ii. 428. — Dietrich, *Syn.* i. 554. — Loudon, *Arb. Brit.* ii. 517, f. 185.

I. ligustrina, Elliott, *Sk.* ii. 708 (not Jacquin). — Spach, *Hist. Veg.* ii. 429. — Darby, *Bot. S. States*, 123.

? *I. Watsonia*, Spach, *Hist. Veg.* ii. 429.

I. Dahoon, var. *angustifolia*, Watson, *Index*, 158. — Sargent, *Forest Trees N. Am.* 10*th Census U. S.* ix. 35. — Trelease, *Trans. St. Louis Acad.* v. 345.

This is the common form in southern Alabama, where it is abundant.

[5] *Ilex Cassine*, var. *myrtifolia*, Sargent, *Garden and Forest*, ii. 616.

I. myrtifolia, Walter, *Fl. Car.* 241. — *Nouveau Duhamel*, i. 10, t. 4. — Michaux, *Fl. Bor.-Am.* ii. 229. — Poiret, *Lam. Dict.* Suppl. iii. 65. — Willdenow, *Enum.* Suppl. 8. — Roemer & Schultes, *Syst.* iii. 489. — Link, *Enum.* 148. — Spach, *Hist. Veg.* ii. 429. — Gray, *Man.* ed. 5, 306. — Maximowicz, *Mém. Acad. St. Pétersbourg*, xxix. ser. 7, 26.

I. rosmarifolia, Lamarck, *Ill.* i. 356. — Persoon, *Syn.* i. 151. — Poiret, *Lam. Dict.* Suppl. iii. 65.

I. ligustrifolia, Don, *Gen. Syst.* ii. 19.

I. Dahoon, var. *myrtifolia*, Chapman, *Fl.* 269. — Sargent, *Forest Trees N. Am.* 10*th Census U. S.* ix. 36. — Trelease, *Trans. St. Louis Acad.* v. 346. — Watson & Coulter, *Gray's Man.* ed. 6, 108.

EXPLANATION OF THE PLATES.

PLATE XLVI. ILEX CASSINE.

1. A flowering branch of the staminate plant, natural size.
2. A flowering branch of the pistillate plant, natural size.
3. A staminate flower, enlarged.
4. A staminate flower, the corolla removed and laid open, enlarged.
5. A pistillate flower, enlarged.
6. Vertical section of a pistillate flower, enlarged.
7. A fruiting branch, natural size.
8. A fruiting branch (var. *angustifolia*), natural size.
9. Cross section of a fruit, enlarged.
10. Vertical section of a fruit, enlarged.
11. A nutlet, enlarged.

PLATE XLVII. ILEX CASSINE, VAR. MYRTIFOLIA.

1. A branch of a sterile plant, natural size.
2. A branch of a fertile plant, natural size.
3. A sterile flower, enlarged.
4. A fertile flower, enlarged.
5. A fruiting branch, natural size.
6. Cross section of a fruit, enlarged.

C.E. Faxon del.

Picart fr. sc.

ILEX CASSINE, L.

A. Riocreux direx.t

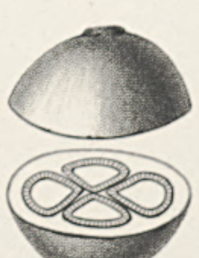
Imp. R. Taneur, Paris.

1

2

5

6



3

4

C.E.Faxon del.

Picart fr. sc.

ILEX CASSINE, Var. MYRTIFOLIA, Sarg.

A. Riocreux direx.t

Imp. R. Taneur, Paris.

ILEX VOMITORIA.

Cassena. Yaupon.

PARTS of the flower in 4's; calyx-lobes obtuse. Leaves crenulate-serrate.

Ilex vomitoria, Aiton, *Hort. Kew.* i. 170. — Salisbury, *Prodr.* 70. — Willdenow, *Spec.* i. 709; *Enum.* Suppl. 8. — *Nouveau Duhamel*, i. 10. — Persoon, *Syn.* i. 151. — Desfontaines, *Hist. Arb.* ii. 362. — Titford, *Hort. Bot. Am.* 41. — Pursh, *Fl. Am. Sept.* i. 118. — Nuttall, *Gen.* i. 109. — Roemer & Schultes, *Syst.* iii. 491; *Mant.* iii. 333. — De Candolle, *Prodr.* ii. 14. — Sprengel, *Syst.* i. 495. — Don, *Gen. Syst.* ii. 17. — Spach, *Hist. Veg.* ii. 430. — Lindley, *Fl. Med.* 393. — Dietrich, *Syn.* i. 555. — Loudon, *Arb. Brit.* ii. 518, f. 186. — Griffith, *Med. Bot.* 433. — Sargent, *Garden and Forest*, ii. 616.

I. Cassine, β. Linnæus, *Spec.* 125.

Cassine Peragua, Linnæus, *Mant.* 220 (in part). — Marshall, *Arbust. Am.* 26.

Cassine Caroliniana, Lamarck, *Dict.* i. 652.

I. ligustrina, Jacquin, *Icon. Pl. Rar.* ii. 9, t. 310; *Coll.* iv. 105.

I. Cassine, Walter, *Fl. Car.* 241. — Aiton, *Hort. Kew.* i. 170 (in part). — Chapman, *Fl.* 269. — Curtis, *Rep. Geolog. Surv. N. Car.* 1860, iii. 59. — Maximowicz, *Mém. Acad. St. Pétersbourg*, ser. 7, xxix. 22. — Sargent, *Forest Trees N. Am.* 10*th Census U. S.* ix. 36. — Trelease, *Trans. St. Louis Acad.* v. 346. — Watson & Coulter, *Gray's Man.* ed. 6, 108.

I. Floridana, Lamarck, *Ill.* i. 356.

I. Cassena, Michaux, *Fl. Bor.-Am.* ii. 229. — Poiret, *Lam. Dict.* Suppl. iii. 65. — Roemer & Schultes, *Syst.* iii. 490. — Elliott, *Sk.* ii. 681. — Darby, *Bot. S. States*, 426.

I. religiosa, Barton, *Fl. Virgin.* 66.

Cassine ramulosa, Rafinesque, *Fl. Ludovic.* 110.

Hierophyllus Cassine, Rafinesque, *Med. Bot.* ii. 8.

Emetila ramulosa, Rafinesque, *Sylva Tellur.* 45.

Ageria Cassena, Rafinesque, *Sylva Tellur.* 47.

A small ramulose tree, twenty to twenty-five feet in height, with a slender often inclining trunk rarely more than six inches in diameter; or generally a tall shrub sending up many stems from the ground, and forming dense thickets. The bark of the trunk is from a sixteenth to an eighth of an inch thick, with a light red-brown surface broken into minute thin scales. The branchlets are stout and placed nearly at right angles with the stems; they are slightly angled and puberulous during the first season, and become glabrous or nearly so the second year, when they are terete and covered with pale gray rugose bark. The winter-buds are minute and obtuse, with narrow dark brown, or often nearly black scales. The leaves are elliptical or elliptical-oblong, obtuse, coarsely and remotely crenulate-serrate; they are coriaceous, dark green and lustrous on the upper surface, pale and opaque below, an inch to sometimes two inches long, a quarter of an inch to an inch broad, and contracted at the base into short broad grooved petioles. They remain on the branches during two or three years, generally falling just before the appearance of the new growth of the third season. The flowers are produced in short glabrous cymes from the wood of the previous year; on the sterile plant they are short-stemmed and many-flowered, and on the fertile plant sessile and one or two-flowered. The slender club-shaped pedicels are glabrous and furnished at the base with minute bracts. Rounded obtuse calyx-lobes with slightly ciliate or entire margins, and an ovary contracted below the broad flat stigma characterize the flowers. The fruit, which is borne on short stems not more than a quarter of an inch in length, is produced in the greatest abundance; it ripens late in the autumn or in the early winter, and falls during winter, or sometimes remains on the branches until the new growth begins. It is scarlet, nearly spherical, and a quarter of an inch across or rather less. The nutlets are prominently few-ribbed on the back and sides.

Ilex vomitoria is found near the coast from southern Virginia to the St. John's River and Cedar Keys, Florida; it extends along the Gulf coast to the shores of Matagorda Bay, and west of the Mississippi River penetrates the interior to southern Arkansas and the valley of the upper Rio Blanco in western Texas, the extreme western station at which it has been noticed. In the Atlantic and west Gulf states the Yaupon is rarely found very far from salt water, or growing to a greater height than

ten or fifteen feet; and it is only on the rich bottom-lands of eastern Texas, where it attains its largest size, that it assumes a really tree-like habit.

The wood of *Ilex vomitoria* is heavy, hard, and close-grained. It is nearly white, turning yellow with exposure, with thick lighter-colored sapwood, and contains numerous conspicuous medullary rays. The specific gravity of the absolutely dry wood is 0.7270, a cubic foot of the dry wood weighing 45.31 pounds.

Branches of this plant covered with fruit are sold during the winter months in the northern cities for decorative purposes.

The Indians of the southern part of the country formerly visited the coast in large numbers every spring for the purpose of drinking an infusion of the leaves of the Yaupon, which are emetic and purgative.[1] These medicinal properties attracted the attention of early travelers in America, and the plant, according to Plukenet, was common in the gardens about London in 1700, the date of the publication of his *Mantissa*, in which it was first described.[2] The Yaupon was early introduced into Bermuda, where it has become naturalized.[3]

[1] Nuñez Cabeça de Vaca saw the Cutalchiches drinking a tea made from the leaves of this tree. "Beben tambien otra cosa, que sacan de las hojas de los Arboles, como de Encina, i tuestanla en unos botes al fuego, i despues que la tienen tostada, hinchen el bote de agua, i así lo tienen sobre el fuego, i quando ha hervido dos veces, echanlo en una Vasija, i están enfriandola con media Calabaça; i quando está con mucho espuma, bebenla tan caliente, quanto pueden sufrir; i desde que la sacan del Bote, hasta que la beben, están dando voces, diciendo; Que quien quiere beber. . . . i estan bebiendola tres dias, fin comer, i cada dia bebe cada uno arroba i media de ella." (*Naufragios*, cap. 26, *Barcia, Hist. Prim. Ind. Occ.* ii.) And the followers of Laudonnière found the Indians in 1564 frequenting the shore of Florida near the mouth of the St. John's River for a similar purpose. "They drinke this Cassine very hotte : . . . they make so great account of this drinke that no man may taste thereof in this assembly unlesse hee hath made proofe of his valure in the warre. Moreouer, this drinke hath such a vertue that assoone as they haue drunke it, they become all in a sweate which sweate being passed, it taketh away hunger and thirst for foure and twenty hours after." (Hakluyt, *Voyages*, ed. Evans, iii. 370.) There is a picture representing the Indians of Florida drinking "Casinam" in the narrative of the French artist, Le Moyne de Morgue, who accompanied Laudonnière to Florida (De Bry, *Voyages*, Part II. t. 29). Accounts of the "Black Drink" of the southern Indians are found also in Charlevoix's *Histoire de la Nouvelle France*, vi. 221, and in John Lawson's *History of Carolina*, 90. See also B. S. Barton, *Coll.* i. 38, 59. — *U. S. Dispens.* ed. 14, 1670; *Nat. Dispens.* ed. 2, 754.

[2] *Cassine vera Floridanorum Arbuscula baccifera Alaterni ferme facie, foliis alternatim sitis, tetrapyrene*, 40. — Catesby, *Nat. Hist. Car.* ii. 57, t. 57.

Cassine, Clayton, *Fl. Virgin.* 33 (excl. syn.).

[3] Lefroy, *Bot. Bermuda, Bull. U. S. Nat. Mus.* No. 25, 59.

EXPLANATION OF THE PLATE.

Plate XLVIII. Ilex vomitoria.

1. A flowering branch of the sterile plant, natural size.
2. A flowering branch of the fertile plant, natural size.
3. A sterile flower, enlarged.
4. Vertical section of a sterile flower, enlarged.
5. Posterior and anterior views of a stamen, enlarged.
6. A fertile flower, enlarged.
7. Vertical section of a fertile flower, enlarged.
8. A fertile flower, the petals removed.
9. Cross section of an ovary, enlarged
10. A fruiting branch, natural size.
11. Vertical section of a fruit, enlarged.
12. Cross section of a fruit, enlarged.
13. A nutlet, enlarged.

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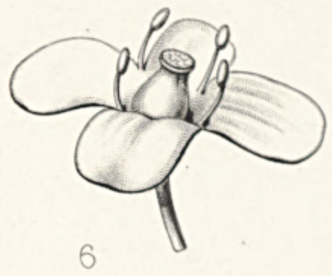

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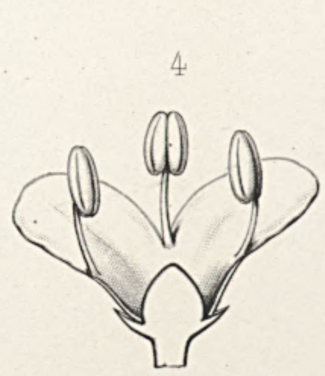

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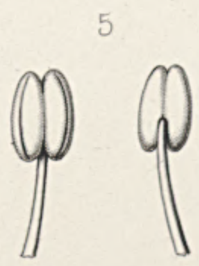

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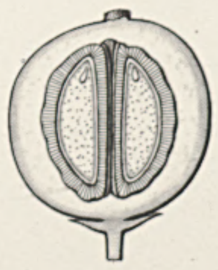

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C. E. Faxon del.

Picart fr. sc.

ILEX VOMITORIA, Ait.

A. Riocreux direx.t

Imp. R. Taneur, Paris.

ILEX DECIDUA.

PARTS of the flower usually in 4's; calyx-lobes broadly triangular. Leaves oblong-spatulate, or lanceolate-obovate.

Ilex decidua, Walter, *Fl. Car.* 241. — Poiret, *Lam. Dict.* Suppl. iii. 65. — Chapman, *Fl.* 269. — Curtis, *Rep. Geolog. Surv. N. Car.* 1860, iii. 59. — Koch, *Dendr.* ii. 227. — Maximowicz, *Mém. Acad. St. Pétersbourg*, ser. 7, xxix. 30. — Sargent, *Forest Trees N. Am. 10th Census U. S.* ix. 37. — Trelease, *Trans. St. Louis Acad.* v. 346, — Watson & Coulter, *Gray's Man.* ed. 6, 108.

I. prinoides, Aiton, *Hort. Kew.* i. 169. — Lamarck, *Ill.* i. 355. — Willdenow, *Spec.* i. 709. — *Nouveau Duhamel*, i. 11. — Michaux, *Fl. Bor.-Am.* ii. 229. — Persoon, *Syn.* i. 151. — Desfontaines, *Hist. Arb.* ii. 362. — Pursh, *Fl. Am. Sept.* i. 118. — Nuttall, *Gen.* i. 109. — Roemer & Schultes, *Syst.* iii. 488; *Mant.* iii. 332. — Watson, *Dendr. Brit.* i. 115, t. 115. — Sprengel, *Syst.* i. 495. — Audubon, *Birds*, t. 89.

I. æstivalis, Lamarck, *Dict.* iii. 147; *Ill.* i. 356.

I. Prionitis, Willdenow, *Enum.* Suppl. 8.

Prinos deciduus, De Candolle, *Prodr.* ii. 16. — Don, *Gen. Syst.* ii. 20. — Loudon, *Arb. Brit.* ii. 520.

I. ambiguus, Elliott, *Sk.* ii. 705.

A small ramulose tree, twenty to thirty feet in height, with a slender trunk six to ten inches in diameter, stout spreading branches, and thin fibrous roots; or more often, a tall straggling shrub. The bark of the trunk is rarely more than one sixteenth of an inch thick, with a light brown surface roughened with wart-like excrescences. The branches are terete and covered with glabrous pale silver-gray bark. The winter-buds are minute and obtuse, with ovate light gray scales. The leaves are deciduous, and, except on vigorous shoots, are fascicled on the ends of short spur-like lateral branches, which in winter are conspicuously marked by the scars left by the falling of the petioles. They are oblong-spatulate or spatulate-lanceolate, acuminate, obtuse or emarginate at the apex, gradually contracted into slender grooved pubescent petioles, and remotely crenulate-serrate, the lower teeth tipped with minute glands. They are two to three inches long, and a third of an inch to nearly an inch in breadth, membranaceous, becoming thick and firm at maturity, pale on the lower surface, with a few scattered hairs along the narrow midrib, light green and grooved along the midrib above. The stipules are filiform, membranaceous and deciduous. The flowers are produced in one or two-flowered glabrous cymes aggregated at the ends of the lateral branches of the previous season, or rarely solitary on the shoots of the year; they appear with the leaves, the sterile flowers on slender pedicels half an inch long and longer than those of the fertile flowers. The calyx-lobes are triangular, the acute apex often dark colored, the margins smooth or sometimes slightly ciliate. The fruit is globose or depressed-globose, orange or orange-scarlet, and a quarter of an inch across; it is borne on short stout stems, and ripens in the early autumn, often remaining on the branches until the appearance of the leaves in the following spring. The nutlets are many-ribbed on the back.

Ilex decidua grows from southern Virginia to western Florida in the high country which lies between the eastern base of the Appalachian Mountains and the immediate neighborhood of the coast. It occurs in southern Illinois, and extends southward to the Gulf of Mexico and through southwestern Missouri, Arkansas, and eastern Texas to the valley of the Colorado River.

Ilex decidua[1] inhabits the borders of streams and swamps in low wet soil. It is usually a straggling shrub in the states east of the Mississippi River, and only in some parts of Missouri and in southern Arkansas and eastern Texas does it assume the habit of a tree.

The wood of *Ilex decidua* is heavy, hard, and close-grained. It is creamy white with rather lighter

[1] This plant is not sufficiently common or sufficiently well known, apparently, in any part of the country, to have acquired familiar popular names.

colored sapwood, and contains numerous thin medullary rays. The specific gravity of the absolutely dry wood is 0.7420, a cubic foot of the dry wood weighing 46.25 pounds.

Ilex decidua, according to Aiton,[1] was cultivated in England by the Duke of Argyll before 1760. It is rarely found in gardens, and is only doubtfully hardy in New England.

[1] *Hort. Kew.* i. 169.

EXPLANATION OF THE PLATE.

Plate XLIX. Ilex decidua.

1. A flowering branch of a sterile plant, natural size.
2. A flowering branch of a fertile plant, natural size.
3. A sterile flower, enlarged.
4. A fertile flower, enlarged.
5. A branch showing the mature leaves, natural size.
6. A fruiting branch, natural size, the leaves just expanding.
7. A fruit with portions of the nutlets exposed, enlarged.
8. A nutlet, enlarged.

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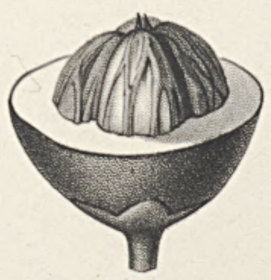

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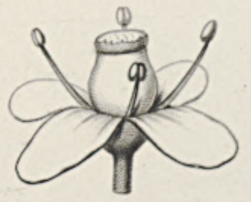

C.E. Faxon del.

Picart fr. sc.

ILEX DECIDUA, Walt.

A. Riocreux direx.t

Imp. R. Taneur, Paris.

ILEX MONTICOLA.

PARTS of the flower usually in 4's or 5's; calyx-lobes acute, ciliate. Leaves ovate or lanceolate-oblong.

Ilex monticola, Gray, *Man.* ed. 2, 264. — Koch, *Dendr.* ii. 228. — Maximowicz, *Mém. Acad. Sci. St. Pétersbourg*, ser. 7, xxix. 30. — Chapman, *Fl.* ed. 2, Suppl. 633. — Trelease, *Trans. St. Louis Acad.* v. 347. — Sargent, *Garden and Forest*, ii. 352. — Watson & Coulter, *Gray's Man.* ed. 6, 108.

I. ambiguus, Torrey, *Fl. N. Y.* ii. 2 (excl. syn.).

I. montana, Gray, *Man.* 276 (not *Prinos montana*, Sw.).

A tree, thirty to forty feet in height, with a short trunk sometimes ten to twelve inches in diameter, slender branches forming a narrow pyramidal head, and fibrous roots; or more often, a low shrub with spreading stems. The bark of the trunk is usually less than one sixteenth of an inch thick, with a light brown surface covered with lenticels. The branchlets are more or less zigzag, glabrous, and covered when they first appear with pale red-brown bark, which becomes dark gray by the end of the first season. The winter-buds are obtuse, with ovate keeled apiculate light brown scales. The leaves are ovate or lanceolate-oblong, wedge-shaped or rounded at the base, and acute at the apex; they are deciduous, membranaceous, long-petioled, sharply and rather remotely serrate with minutely glandular teeth, glabrous or sparingly hairy along the veins on both surfaces. They are four or five inches long and a half to two inches broad, or at the north often much smaller, light green above, pale on the lower surface, with a prominent midrib and primary veins. The flowers appear in June when the leaves are more than half grown, and are produced in one to two-flowered cymes aggregated at the ends of the lateral spur-like branches of the preceding year, or solitary on the shoots of the season. The pedicels of the sterile flowers are half an inch long, and much longer than those of the fertile flowers. These are characterized by acute calyx-lobes with ciliate margins and by an ovary contracted below the broad flat stigma. The fruit is globular, nearly half an inch in diameter, bright scarlet, and crowned with the remnants of the large stigma. The nutlets are deeply ribbed on the back and sides.

The most northern stations where *Ilex monticola* is known to grow naturally are the Catskill Mountains and Cattaraugus County, New York; it extends through the mountains of Pennsylvania, its eastern station in that state being in Northampton County, and southward along the mountains to northern Alabama. It is only on the lower slopes of the Alleghany Mountains in North and South Carolina that *Ilex monticola* attains the habit and size of a tree, reaching its greatest development on the banks of streams flowing from the Blue Ridge, where it is often found growing in peaty soil in thickets of the Great Rhododendron, and accompanied by the Mountain Magnolia, the Yellow Poplar, the Black Birch, the Yellow Birch, the Red Maple, and the Mountain Ash.

The wood of *Ilex monticola* is hard, heavy, and close-grained. It is creamy white, and contains numerous thin medullary rays. The specific gravity of the absolutely dry wood is 0.6563, a cubic foot weighing 40.90 pounds.[1]

Ilex monticola was apparently overlooked by the early botanists who explored the forests of the Alleghany Mountains; and it was not distinguished until about 1840, when Mr. John Carey[2] discovered it on the Catskill Mountains.

[1] This tree apparently grows very slowly. The specimen in the Jesup collection of North American woods in the American Museum of Natural History, New York, is five inches in diameter, and shows one hundred and seven layers of annual growth, of which seventy-nine are sapwood.

[2] John Carey (1798–1880); a native of London, who removed in 1830 to the United States where he resided until 1852, when he returned to England and engaged in commercial pursuits. On his arrival in America Mr. Carey settled first at Tonawanda, New York, then in Vermont, and finally in the city of New York. He had acquired a taste for the study of botany before leaving England, and on his arrival in America began at once to devote himself assiduously to the study of the flora of the northern states, forming intimate relations with Drs. Torrey and Gray. With the last

The large brilliant fruit and ample foliage of this species make it the most ornamental of the deciduous-leaved Hollies of North America, and a desirable garden plant. It was introduced into cultivation in 1888 at the Arnold Arboretum.

he made in 1841 a long journey through the mountains of the southern states. Mr. Carey occupied himself specially with the study of the genus Carex, and contributed the articles on that genus and on Salix to the first edition of Gray's *Manual of the Botany of the Northern United States.* His herbarium of American plants was presented several years ago to the Royal Gardens at Kew.

EXPLANATION OF THE PLATE.

Plate L. Ilex monticola.

1. A flowering branch of a staminate plant, natural size.
2. A flowering branch of a pistillate plant, natural size.
3. A staminate flower, enlarged.
4. A pistillate flower, enlarged.
5. A pistillate flower, petals removed, enlarged.
6. A fruiting branch, natural size.
7. Cross section of a fruit, enlarged.
8. Rear view of a nutlet, enlarged.
9. Side view of a nutlet, enlarged.

C.E. Faxon del.

Picart fr. sc.

ILEX MONTICOLA. Gray.

A. Riocreux direx.t

Imp. R. Taneur. Paris.

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